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Iron Foundry Assists Pattern Shop

Castings Made from Patterns to Discover Molding Troubles—Wood Patterns are Made for Trial Before Metal Equipment is Furnished—Stove Designer Works With Patternmaker

BY H. E. DILLER

DEFECTIVE castings may be attributed to so many contributing factors that the process of elimination alone can locate definitely the cause for poor results. For this reason any steps which serve to guarantee correct practice in patternmaking, molding, metal mixing, melting or pouring serve to mark real progress toward uniformly successful results. The foundry laboratory sponsors its contribution to successful results by experimental data, supported by the best informed metallurgical knowledge, and the responsibility for defective castings in most cases may be transferred at will from the molder to the patternmaker with no sure means of determining which may be to blame. The design and construction of successful patterns partakes both of the scientific and artistic. To emphasize the scientific element and to determine that its product really is practicable has resulted in a novel undertaking by the Cope-Swift Co., Detroit, manu-

FIG. 1—CORNER OF THE PATTERNSHOP IN WHICH STOVE WORK IS DESIGNED AND ART WORK IS CARVED ON THE PATTERNS

Fig. 2—Pattern and cores for an Oil Pan—After the Fingers Shown at A Were Thickened and Wired to Prevent them from Breaking—A Good Casting Was Secured from This Pattern as Shown.

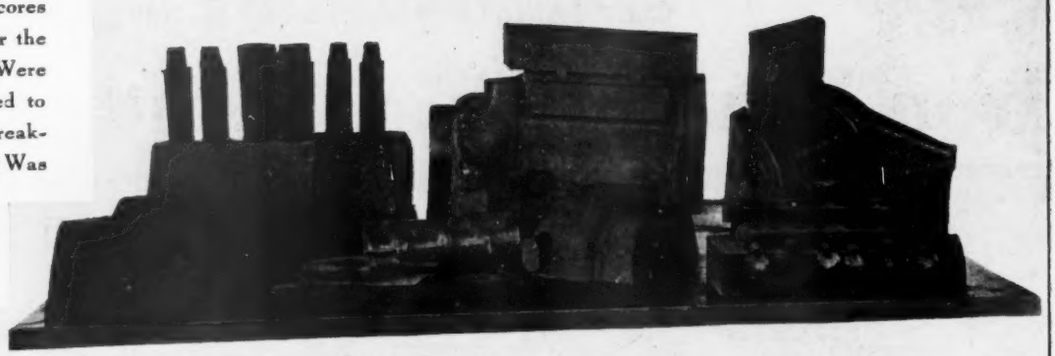
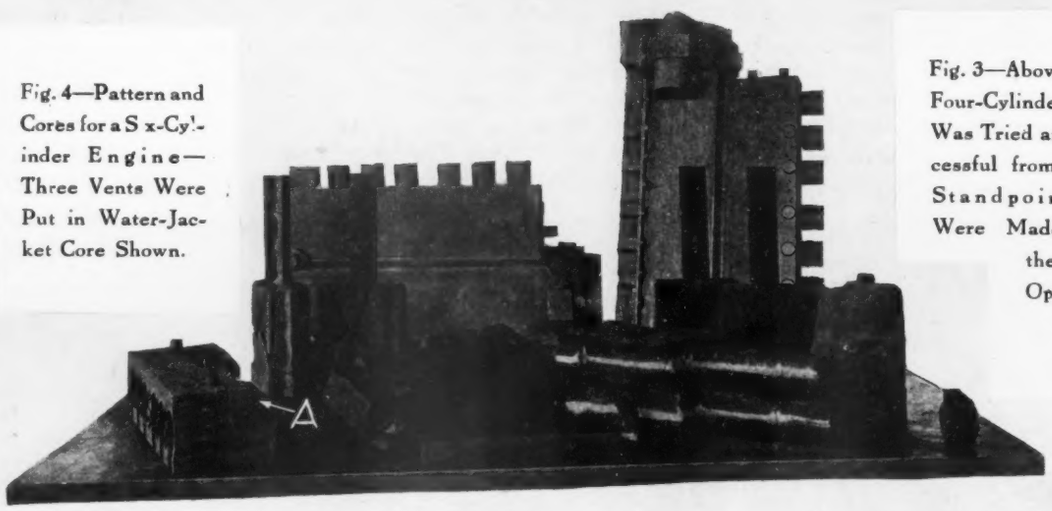


Fig. 3—Above—New Design Four-Cylinder Gas Engine Was Tried and Proved Successful from a Molding Standpoint but Changes Were Made to Facilitate the Machine Shop Operating Needs.

Fig. 4—Pattern and Cores for a Six-Cylinder Engine—Three Vents Were Put in Water-Jacket Core Shown.



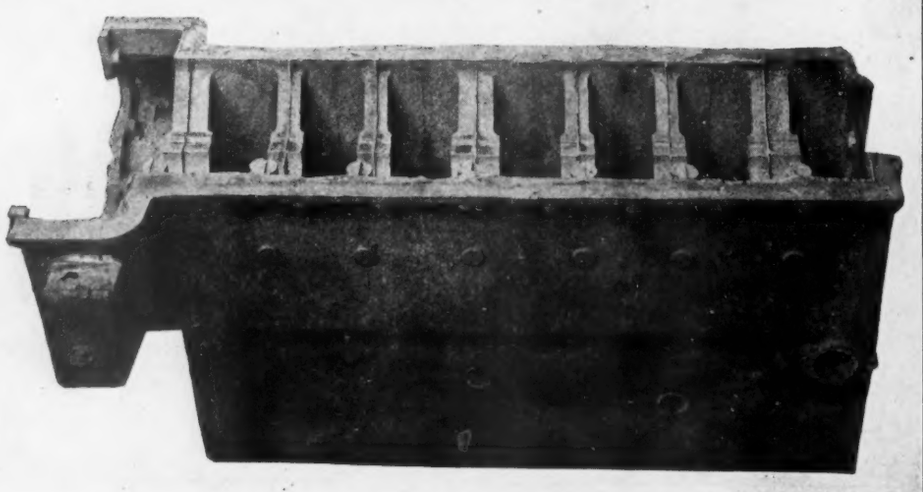
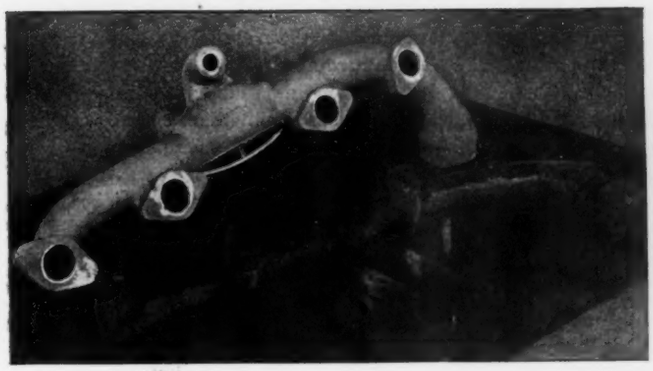


Fig. 5—Casting from the above Pattern—Note the Three Holes Made in the Side by the Prints of the Core Vents Mentioned.



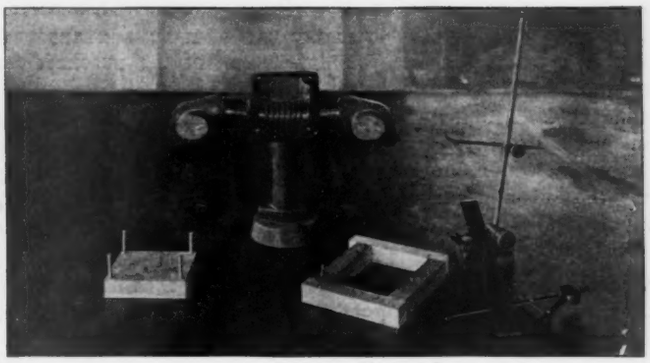


FIG. 6—THE JACKET CORE WAS NOT STRONG ENOUGH AT FIRST BUT AFTER BEING BUILT UP AND WIRED PROVED SATISFACTORY FIG. 7—TEMPORARY EQUIPMENT FOR MAKING A CORE WAS BUILT AFTER GREEN SAND PROVED INADEQUATE FOR MOLDING THE HOLLOW PORTION

facturer of patterns. Some years ago this company established a small gray-iron foundry as an adjunct to its pattern establishment. This foundry was built for the sole purpose of testing and trying all patterns before delivery to the customer, in order that assurance might be given that they were scientifically correct and would produce perfect castings. Previously many foundries have operated pattern shops as subsidiary departments, but this is one of the first pattern shops to establish a contributary foundry. The design of a pattern is governed by the intended service of the castings made from it and by its practical molding qualities. The engineer usually decides the former factor and suggests a design to conform to foundry conditions as he understands them. Should the patternmaker assume that the design is not correct for molding practice he seldom has an opportunity to demonstrate the correctness of his theory by trial before the final pattern is made. The necessity for studying the design of a pattern from the viewpoint of the foundryman has been met by the Cope-Swift Co. in its experimental foundry, operated on practical lines.

FIG. 8—THE MASTER PATTERNS FOR A STOVE ARE ASSEMBLED BEFORE THE PLATES ARE MADE—THIS HELPS TO INSURE CORRECT EQUIPMENT

Since its establishment this foundry has proved beneficial to the company in many ways in addition to the one originally intended. Very frequently blue prints are received for a pattern which the company feel is not practical but which the engineer who designed the pattern believes to be feasible. In such a case a few trials in the foundry soon will show who is right. Again a pattern is made and the company which receives it reports that successful castings cannot be made from it as it is designed. In such a case the Cope-Swift company can produce castings made from the pattern, and, if necessary, can give detailed instructions as to how it should be molded, even to the proper method of venting the cores. The experimental foundry is of serv-

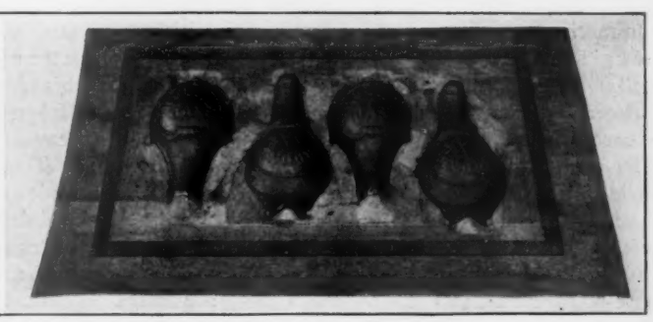


FIG. 9—MORE THAN A HUNDRED PLATES ARE OFTEN MADE FOR ONE STOVE—NOTE THAT SOME PATTERNS ARE CAST IN THE PLATE WHILE OTHERS ARE ATTACHED WITH SCREWS FIG. 10—PATTERNS ARE MOUNTED ON A BOARD FOR MAKING PLATES

ice when a casting of a new design is to be made. In this case the casting is produced in the foundry from a wooden pattern. It then is inspected. One casting perhaps is broken in pieces to determine the thickness of walls, while another may be sent to the machine shop where it is studied after machining.

The foundry also is valuable for working out details of patterns for stoves which are designed by the company. Not only is the foundry available for trying patterns made by the Swift-Cope Co., but other pattern-shops send their patterns to have sample castings made from them.

The ways in which the foundry serves in manufacturing patterns may be described best by examples. Fig. 7 shows a pattern for a manifold of

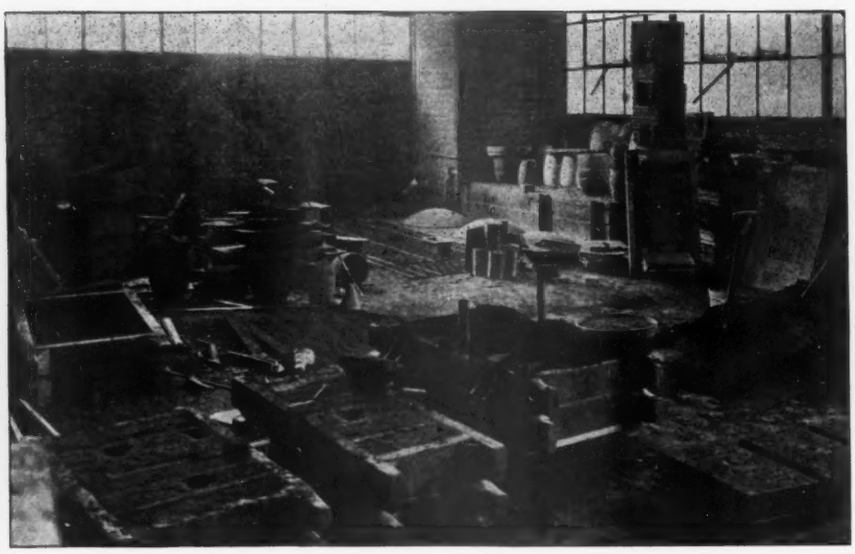


FIG. 12—FOUR CRUCIBLE FURNACES IN ONE CORNER OF THE SHOP SERVE TO MELT THE ALLOYS FOR PLATES AND PATTERNS

a new design. Not only were molding problems involved in this instance but only a few castings were wanted at first to determine whether the casting was practical for the purpose for which it was designed. For these reasons a wood pattern was made. It was intended to make the mold in green sand without a core, but after trying several castings it was decided that this method of molding is impracticable. The pattern now is being fitted with a frame. This frame will be temporarily attached to the pattern which will then be used as a core box for making dry sand cores. The print for the core will be formed inside the frame. When the pattern is molded the block shown to the left, Fig. 7, will be placed over the cavity in the same position as the core-print, and fastened to the core-print with dowl pins. The core-print will be anchored through the cope with wire. After castings have been made and approved by the engineers of the purchaser, a metal pattern and a corebox will be made.

Manifolds are difficult castings to make, mainly on account of the core work and the thinness of the wall section. The walls of the one just described are only ⅛-inch thick. A manifold casting of another design is shown in Fig. 6. The first one of these which was made was defective due to failure of the water jacket core, shown in the foreground. The size of this core was increased to secure a greater body of sand which could be wired. A second casting made after the core had been strengthened proved satisfactory, but before making a metal pattern, 110 castings will be made and sent to the purchaser who will machine them and subject them to a water test before giving his approval of the pattern. The two cores are located by the prints which are seated in the drag. They are held down by perforated chaplets.

An automobile company which is designing a new 4-cylinder engine to drive through the front wheels sent drawings to the Cope-Swift Co. from which patterns were made. Fig. 2 shows the pattern and cores for the oil pan of this motor. Trouble was experienced when the first casting was made because the fingers, shown at *A*, broke. These portions of the core were made slightly larger and wired. After doing this satisfactory castings were produced. The pattern and cores for the engine castings are illustrated in Fig. 3. The coke which has been placed in the center of one of the heavier cores is indicated by the spot, at *A*, in the center of the end casting to the right. The first casting made from this pattern was satisfactory from a foundry standpoint but some changes in the design suggested by trials in the machine shop, were made. Then the design was approved and a metal pattern will now be made.

The pattern and cores for a 6-cylinder gasoline engine are shown in Fig. 4. The large and small cores to the right are for the housing. To the left of them are four of the 6-cylinder barrel cores. The long narrow core at the front is the manifold core which fits into the jacket core at *A*. The heavy core behind the manifold core is for the face of the last cylinder barrel. A casting was made off this pattern as designed by the purchasing company. Trouble was experienced in removing the gas from the water-jacket core and three prints were added on the face of the jacket core, which extend into the cope side of the mold. These prints may be seen on the jacket core to the right of Fig. 4 at *B*, and the holes made by them are shown in the casting from this pattern in Fig. 5. After the core is shaken out the holes are threaded and stopped with cast iron plugs which are screwed into them. The plugs are then finished flush with the side of the casting. The trial pattern is now ready for a few finishing touches after which the metal pattern equipment will be made. This metal equipment often includes vent-plates for cores. These are flat plates with raised ridges for making a groove in the center of the core which is formed against the plates. In this way a vent hole of regular outline is secured at a definite place in the center of the core, whereas the molder by scratching a vent hole in the sand frequently forms an irregular groove. The vent hole is located by pins in the core boxes.

Stoves Designed

The stove work of the Swift-Cope Co. is a distinct department. A customer who wishes a stove of a new design brings his ideas to the company and asks them to submit their recommendations. Sometimes the only information given is that a combination coal and gas stove with an oven of a certain size is wanted. At other times an old stove is sent to the company for improvements. Such a stove is shown in Fig. 1. A model of the ornamental work is made of clay for the customers inspection and approval. This is an effective way of showing the exact appearance of the new design. At other times a preliminary sketch only is needed, but the best results usually are ob-

tained from a clay model as it is difficult to get a clear idea of how the finished stove will appear from a sketch.

After an idea has been secured from the clay model a preliminary sketch is made, such as is shown in the center of Fig. 1. The white portions of this sketch represent nickel. In this illustration a portion of the work bench is shown. The designer who makes the clay models and carves the ornamental work on the patterns as well as a patternmaker who makes minor changes on the patterns and does any necessary finishing, work in this section separated from the main pattern shop.

When the preliminary sketch has been approved full size working drawings are made. From these drawings wood patterns are made and iron master-patterns are cast from them. The iron master-patterns then are assembled and fitted into a complete stove. This step in making a set of stove patterns is shown in Fig. 8. All the pieces are carefully fitted together. Venetian red is applied at the joints to show where the different pieces touch each other. After the iron master-patterns have proved satisfactory, aluminum plates are made. Many stoves require more than 100 different plates. Castings from the master-patterns are usually made thicker than the pattern on account of the way the molders rap the patterns. For this reason in assembling the stove from the master-patterns thin shims or *makages*, as they are known to the patternmaker, are placed between certain of the parts when they are fitted together.

Making the Plates

In making the plates the patterns are mounted on followboards as shown in Fig. 10. The cope is made first and the drag is molded on top of it. Then the two parts are separated by the frame shown in the illustration and sand is rammed around the outside edge of the frame to the edge of the flask which extends out about 3 inches beyond the frame. After the frame is withdrawn the mold is ready for pouring and will produce a plate the thickness of the frame with patterns of the casting upon it At other times the patterns are mounted on flat plates with screws, as shown at *A*, Fig. 9. At *B*, in the front of this illustration, which shows a number of different style plates for stove work, may be seen a flat aluminum plate for mounting the two narrow plates lying beside it. After the plates are finished, sample castings are made from them. These castings are mounted into a complete stove and any necessary finishing touches are made on them before they are sent to the customer.

Although only two classes of work have been described the company makes many other varieties of patterns, and it is interesting to note that it makes all its gray-iron castings from the same class of iron and finds no difficulty from this practice. Stove castings and automobile cylinders are cast from the same ladle of metal, although in general practice it is thought that the one grade of castings requires a high-phosphorus iron and the other a low-phosphorus metal.

A cupola lined to 32 inches diameter generaly is used although there is also a 24-inch cupola in the foundry. Before being put into the cupola the pigs of iron are broken into quarters. Five hundred pound charges, consisting of 33 per cent scrap and 67 per cent pig iron are used. Between each two charges is placed 175 pounds of coke. This gives hot iron and avoids trouble from cold shuts and misrun castings. The iron is held in the cupola until it reaches the tuyeres before being tapped, when it is run into a 1-ton ladle. This is carried down the center aisle of the foundry on an air hoist traveling on an I-beam track which is shown to the right at the top of Fig. 11. From this center aisle the metal is carried to the molds in bull or hand ladles. The foundry melts from 4½ to 5 tons of metal a day. All of this iron does not go into experimental castings as the company takes a small amount of production work in order to provide an outlet for enough work to warrant running the cupola every day.

The importance of uniform iron is realized when it is considered that master-patterns as well as experimental castings are made with it and require a metal which will always have the same shrinkage and which must machine readily. A shrinkage of ⅛-inch per foot is obtained regularly. This eliminates much trouble which might arise due to any variation in the size of the castings. In order to secure a soft machineable casting, a high-silicon iron is used, and to obtain an iron which will run well and give a sharp impression in the ornamental stove work, the phosphorus content is kept fairly high. The average metal contains 2.50 per cent silicon, 0.07 per cent sulphur, 0.60 to 0.70 per cent phosphorus and 0.50 per cent manganese.

FIG. 11—THE FOUNDRY HAS TWO SMALL CUPOLAS—IN THE BACKGROUND TO THE RIGHT ARE THE CORE OVENS AND THE CORE ROOM

Few chemical tests are made. The furnace analysis is taken for the pig iron but every time a new car of pig iron is started in the mixture a sample of the resulting metal is sent to the Detroit testing laboratory for analysis. Any changes in the mixture, which this test shows to be necessary, are made and a sample for analysis is not taken again until a new iron is introduced into the charge.

Aluminum and other alloys for plates and patterns are melted in four crucible pits shown in Fig. 12. Pattern and experimental castings are cleaned by sandblasting. For this purpose a rotary table sandblast machine furnished by the American Foundry Equipment Co., Cleveland, is used.

Points Merits of Electric Furnace

The Electric Furnace for Foundry Use is Contrasted With Other Steelmaking Units—Differing Types of Furnaces Are Compared—Greater Strength and Homogenity Claimed for Electric Steel

BY W. E. MOORE

AT THE end of 1913 there were only 19 steelmaking electric furnaces installed in America. This number had increased to 136 at the end of 1916 and to 269 at the end of 1917. At present the number of steelmaking furnaces in use in various industrial countries of the world is 815, of which 290 are in the United States and 45 in Canada.

The average capacity of these furnaces used in steel ingot production in America is 7.3 tons per heat, and in the foundry melting is 1.7 tons per heat, though the ordinary size now most generally used in foundries is the 3-ton unit. More than 99 per cent of all the steelmaking furnaces are the arc type and less than 1 per cent the induction type.

Electric furnaces are used for the following principal purposes in the metal industries:

Making forging steels, tool steels, alloy steels, etc.

Making steel castings in foundries.

Making high grades of strong cast iron for difficult or fine castings.

Melting brass, bronze and other nonferrous metals.

Acid furnaces are those lined with silicious refractories and are used for melting and alloying steel made from a high grade of scrap, where the sulphur and phosphorus impurities are so low that much refining is not deemed necessary as in making steel castings or merchant-bar steel.

Basic Process Refines

The strength of cast iron is greatly improved by melting or treating in an acid electric furnace, though where it is necessary to reduce the sulphur or phosphorus content materially the basic furnace must be used. It is, possible, however, in a properly operated acid furnace to reduce such impurities by only a small percentage. The amount of this possible reduction is not over 10 to 15 per cent.

With basic furnaces the refractory linings are much more resistant to the lime slags carried as a molten blanket on top of the steel bath for taking up and fluxing out the sulphur and phosphorus. Phosphorus is removed in the first operation. High-calcium slags, when in contact with metal under oxidizing conditions as when iron ore or mill scale is added to the bath and at not too high temperature, have a strong affinity for phosphorus which is quickly absorbed by the slag during that period of the heat known to the melters as the *boil*. The phosphorus from the metal is thus oxidized into phosphoric acid and then converted into phosphate of lime, in which form it is a stable constituent of the slag, provided the temperature is not carried too high. This first or oxidizing slag is then skimmed off and another slag is made by adding lime and carbon, which is fused by the heat of the arc. This slag then forms calcium carbide, or the *carbide slag*. Carbon, such as granular coke, retort carbon or anthracite coal, is used with high-calcium, low-magnesia lime. This carbide slag under high heat and in a reducing atmosphere has a strong affinity for sulphur and carries it off from the steel, absorbing it in the form of calcium sulphide. It is thus possible, though not always commercially practicable, to make a high grade of tool steel from impure scrap in an electric furnace. Heretofore tool steel could be made only by melting the purest forms of Norway or Swedish iron, and then only by melting in crucibles, which is a slow and expensive process and one in which no refining is possible.

Primarily, electric steel became popular because of its desirable physical properties. Experience has demonstrated that when made according to the same chemical analysis electric steel will have about 15 per cent greater tensile strength or ductility, depending upon its heat treatment, and that it is more resistant to shock and better able to receive heat treatment than steel made by other standard processes. The reason for this is that the steel, being made in a closed furnace and in a reducing atmosphere away from the contaminating influences of combustion gases, is more solid, freer from gases and less exposed to nonmetallic inclusions of slag oxides, etc. As an example, the tests shown in the following table, made by R. W. Hunt & Co., Chicago, Jan. 30, 1919, for the Chicago surface lines, illustrate the physical properties of a heat-treated electric-furnace axle steel. It was heated to from 1450 to 1460 degrees Fahr., held one hour, quenched in oil at 65 degrees, drawn at from 1185 to 1200 degrees Fahr. for one hour and then slowly cooled in the furnace. The open hearth steel was also heat-treated in the same manner. The results follow:

	Open hearth	Electric furnace
Elastic limit, lb. per sq. in....	41,060	64,850
Tensile strength, lb. per sq. in.	89.100	105.140
Per cent elongation in 2 in.....	21.5	22.0
Per cent reduction of area.....	31.74	52.37
Elastic torsion	16,750	33,700
Character of fracture.....	Granular	Silky cup

The bureau of standards reports regarding the superior qualities of electric steel as follows:

The characteristics of electric steel are great homogenity and freedom from segregation. It is somewhat higher in tensile strength and elastic limit than other steels and, owing to its greater density, shows a marked resistance to fatigue.

When properly made and averaging lower in sulphur, electric steel in the foundry is less liable to show shrinkage cracks between ribs of castings, and, being more fluid, it is not so liable to piping, blowholes, cold shuts or misruns, and in tool steel it takes heat treatment more effectively and will stand greater abuse in heating.

Useful for Alloys

The electric furnace is especially useful for making alloy steels. Since the metal is treated in a reducing atmosphere, there need be no large losses of the added elements, such as silicon, manganese, vanadium and chromium, which in the ordinary open-hearth practice are oxidized in large quantities and carried to waste in the slag, thus producing uncertain mixtures. With the electric furnace it is much easier to carry the finishing operation to a limit in carbon and silicon content, and to finish with an absence of the gases of solution and inclusion, such as oxygen and nitrogen.

In open-hearth furnaces it is impracticable to melt down fine scrap such as turnings in quantity without additions of pig iron, for the oxidizing flame, which furnishes the heat to the furnace, will reduce the scrap metal when in an

Abstracted from a paper presented at the recent annual meeting of the American Society of Mechanical Engineers. The author, W. E. Moore, is director of the research laboratory, Aluminum Castings Co., Cleveland.

attenuated form to a mass of oxide before it becomes molten. With the electric furnace it is entirely practicable to melt turnings exclusively, which under ordinary market conditions are priced from $5 to $10 per ton lower than the heavy melting grade of steel required in open-hearth practice.

In the electric furnace it is practicable to obtain a heat-transfer efficiency of from 60 to 70 per cent of the heat energy in the electric power supply put into the molten charge, whereas with open-hearth practice the efficiency ranges from 8 to 15 per cent and in a crucible furnace from 2 to 6 per cent. However, the fuel-developed heat unit in the open-hearth furnace is much cheaper than the heat unit supplied as electric power, and if the electric furnace did not have the other advantages mentioned it could not at present compete against the open-hearth furnace in the cost of heat energy.

On account of the intense heat of the electric arc, it is possible to melt quite rapidly. Thus in the electric furnace it is possible to melt and refine a charge of foundry steel in one hour or less which in the open-hearth furnace might require from six to 14 hours. In other words, a 12-ton electric furnace may be practically equivalent to an 80-ton open-hearth furnace in steel output and cost less for installation. A 12-ton electric furnace of course requires a correspondingly smaller ladle, crane and building structure, for it is the practice to tap the entire heat into one ladle with either type of furnace.

Table I

Average Cost Per Ton for Two Tons of Converter Steel Divided Into Four Cupola Charges

Two-ton Converter Charge	Cost per ton of Liquid Steel
Low-phosphorus pig iron	$14.09
Bessemer pig iron	7.89
Steel scrap	10.14
Silicon and spiegel	5.55
Coke, 863 lb.	1.01
Cost of material per ton of liquid steel	$38.68
Additions per ton of steel:	
10 lb. 80 per cent ferromanganese at 6 cents	0.60
6 lb. 50 per cent ferrosilicon at 5 cents	0.30
2 lb. aluminum at 30 cents	0.60
Power for blower motors	1.25
Cost of materials and power per ton of liquid steel	$41.43
Average cost of cupola and converter linings	1.20
Labor costs	3.00
Cost of converter steel per net ton in ladle	$45.63

Arc furnaces may be classified into long-arc and short-arc types. There are many theoretical inducements to use the long-arc furnaces, for with a given energy input the electrode is correspondingly smaller and the electrode cost therefore reduced proportionately. With the water-cooled bottom-contact type furnace either the furnace size must be kept small or the voltage must be greatly increased in order to keep the current low and prevent that form of contact from overheating, so it is the custom to operate the bottom-electrode furnace with quite a long arc and low current, and in small sizes only.

Arc furnaces may again be classified into single-phase, two-phase, and three-phase types. The single-phase furnace is ideally simple but is poorly adapted to modern power-plant conditions, as central-station power today is universally generated and transmitted in three phases. The long-arc single-phase furnaces, too, have the great disadvantage of operating on extremely low power factor, thus causing a great waste in transformer, line and generator capacity, which usually makes them prohibitive from the central-station man's viewpoint in any but quite small sizes, say, ¼-ton to 1-ton capacity per heat.

The two-phase furnace may be operated either from two- or three-phase power, but when operated from the usual three-phase power the phases have to be transformed by Scott-connected transformers, which are more costly and less efficient than the straight three-phase transformers and frequently unbalance the power system. The two-phase furnace usually is built with four arcing electrodes and, while it gives a theoretically balanced load on the power system, it has the objection of requiring an additional electrode, which increases the electrode consumption 33 per cent over the three-phase furnace.

Table II

Average Cost Per Ton for Three-Ton Acid-Lined, Rapid-Type, Polyphase, Electric Furnace Foundry Steel

Three-ton Electric-Furnace Charge	Cost per ton of Liquid Steel
Axle turnings	$12.40
(included above 3 per cent losses, 200 lb.)	
Mill scale	0.09
(included above 60 per cent losses, 60 lb.)	
Electrodes at 7 cents	1.40
1650 kw-hr. (550 per ton) at 1 cent per kw-hr	5.50
Losses in melting 260 lb.:	
80 per cent ferromanganese	0.40
50 per cent ferrosilicon	0.25
Aluminum at 30 cents	0.15
Cost of material per ton of liquid steel	$20.19
Average cost of linings and roofs	0.40
Labor cost on furnace attendance	1.00
Cost of electric steel per net ton in ladle	$21.59

The three-phase furnace for installations of moderate and large size is the most universally satisfactory and popular furnace, fulfilling all the conditions as to balanced load and high power factor required by the central stations, at the same time giving the minimum electrode loss and the simplest form of automatic electrode-adjusting gear.

The acid-type furnace is best suited for foundry work and the most popular size has a capacity of 3 tons per heat, though sometimes 1½-ton or smaller furnaces are required. The more high powered and rapid furnaces for such work turn out from 8 to 16 heats in 24 hours, and with a power consumption of from 500 to 650 kilowatt-hour per ton of liquid steel. Considering the ultimate efficiency of the large modern turbo-generator power house at 1½ pounds of coal per kilowatt-hour, the fuel consumption of the furnace may be said to be the equivalent to 750 to 900 pounds of coal per ton melted, and the coal need not be of high grade nor low in sulphur and phosphorus as is necessary with fuel-fired furnaces. Basic furnaces require more time and power, heats ranging from four to eight per day, and since the charge is melted in a reducing atmosphere there is practically no oxidation of the metal. For this reason thin scrap, light turnings or scrap of other forms may be melted. Such scrap on the present market sells for approximately from $5 to $10 per

ton less than low-phosphorus, heavy-melting scrap necessary with the ordinary acid open-hearth melting-furnace installation.

The reducing furnace atmosphere makes it easier to refine and kill the steel, resulting in a saving amounting frequently to $2 per ton. The melting losses in the electric furnace are low, averaging from 2 to 5 per cent as against 6 to 9 per cent in the open hearth and 16 to 24 per cent in the converter process. The electric furnace does not contaminate the metal as do fuel-heated furnaces and an acid electric will therefore readily make No. 3-U.S.A. specification steel. The saving alone in the cost of melting stock will more than pay for the entire conversion cost of electric steel. The deader, more dense electric steel yields a larger percentage of good castings and the lower sulphur renders them free from shrinkage, flaws and cracks, while the hotter and more fluid steel renders possible thinner and lighter-weight sections than can be produced commercially by other processes.

Electric furnace steel may be alloyed readily with nickel, chromium and vanadium to make the higher grades of steel castings to replace forgings and for special purposes, such as may be required for parts of unusual strength, or ductility, or for cutting tools. It is feasible to make castings which will run up to an ultimate strength of 130,000 pounds per square inch, or to cast high-speed-steel milling cutters and reamers to form for grinding. The figures in Tables 1 and 2 show present-day comparative operating costs for liquid steel in the ladle under favorable conditions—as in a steel foundry under 24-hour per day operation.

The electric furnace is coming into use for the finer grades of cast iron and for melting cheap cast-iron scrap, such as borings, which cannot be successfully melted in the cupola. The electric furnace greatly improves the strength of cast iron, even in acid melting. G. K. Elliott reports a cupola iron showing a transverse load of 2950 pounds with a 0.10-inch deflection in a standard arbitration test bar. After 25 minutes' treatment in the electric furnace, using 104 kilowatt-hours per ton, a similar bar was cast and broke at 4400 pounds with a 0.115-inch deflection.

Excellent results have been obtained with malleable iron made by treating cupola metal or by melting cold scrap in an electric furnace. The ability to refine for sulphur and phosphorus, and the facility with which ferroalloys may be added to adjust the mixture to the proper malleableizing formula render the electric furnace a decided advantage in malleable-iron foundries, particularly in working on high-phosphorus southern irons. Where an ample supply of cheap, light scrap, such as cast-iron borings, is obtainable, along with suitable electric power, the cost of electric-furnace cast iron in some cases is less than that of the cupola-melted iron. The electric-furnace iron may always be brought to the proper formula for difficult casting conditions, for instance, as when casting gas-engine piston rings to size ready for grinding in a cast-iron chill mold.

Many factors govern the selection of the proper furnace to meet given conditions. If the scrap be inferior and high in sulphur and phosphorus, then the extra cost, slower operation and shorter refractory life of the basic furnace must be endured to obtain the lower limits of sulphur and phosphorus not practicable to reach with the acid furnace using poorer grades of scrap. At present the call is for acid-lined furnaces, and cheap, good scrap is available in large quantities for foundries, and basic furnaces for alloy and tool steel. The acid furnace is simpler, cheaper and faster to operate and the steel casts more easily, while the basic furnace is essential for tool steels.

It is nevertheless strongly recommended in any case that a furnace purchased be so designed and constructed that it is adaptable to basic operation. This means that the furnace shell must be of large diameter and the bath of large area and shallow. The furnace should not, it is thought, be of the long-arc type, nor of the small-diameter-shell, deep-bath type if the best and most rapid work is contemplated. Indeed, even for acid melting there is a noticeable difference in the quality of the steel obtained from the large-diameter, shallow-bath furnaces compared with that made in the deep-bath type furnace, for with the latter it is not feasible to obtain the same mechanical reactions from the additions put in to refine and kill the steel as when the bath is the shallower type. Nor is it possible so thoroughly to deoxidize the metal by maintaining a reducing atmosphere in the furnace.

For rapid work it is especially important to have the furnace constructed with all possible operating conveniences and facilities, so that one heat may follow another with the utmost rapidity and with a minimum loss of time for the necessary furnace adjustments. It is therefore important to look carefully to the facilities for making bottom and fettling the banks.

It is quite important that the furnace should operate at the highest practicable power factor that can be obtained without undue disturbance of the power company's load, for by so doing the electrode, transformer, line and generator losses are maintained at a minimum. Engineering skill of a high order is required to forecast and select the best type of equipment.

Preventing Cylinder Leaks

Question:—We are making a gas engine cylinder which is causing us a lot of trouble. About 40 per cent of the castings leak when subjected to a hydraulic test of 200 pounds per square inch. The castings are poured horizontally with a flow-off riser at each end. The cores are made with linseed oil. We would like to know: (1) The composition of cast iron required; (2) what grade of pig iron should be used.

Answer:—Your trouble may be due to one or more of three causes:

1—Imperfect design of pattern in that some sections are much thicker than others; this will result in the thin sections setting or solidifying first. The heavier sections setting afterward shrink more and as a result there will develop either an actual opening or a porous place at the line where the two sections meet.

2—Poor molding practice; the sand for making castings of this description must be tempered properly. Wet sand or hard spots in the mold will cause the metal to boil and this will result in porous spots in the casting. Hard or poorly vented cores will do the same.

3—Iron which is high in silicon and low in manganese will not produce sound homogeneous castings. On the other hand iron of the proper analysis may be spoiled in the melting. Assuming that your melting practice gives you hot fluid iron, any combination of pig iron and scrap which will yield the following analysis will prove satisfactory: Silicon 1.80 to 2 per cent; manganese 0.60 to 0.70 per cent; sulphur 0.06 to 0.10 per cent and phosphorus 0.60 to 0.70 per cent.

Opens District Offices

The Booth Electric Furnace Co., Chicago, has opened the following district offices in connection with the sales of electric furnaces for melting steel, iron and nonferrous metals: For New York and New England, Edward B. Stott & Co., Flatiron building, New York; for eastern Pennsylvania, New Jersey, Maryland, Delaware and the southern Atlantic coast states, Northern Engineering Co., 308 Chestnut street, Philadelphia; for northeastern Ohio, western Pennsylvania and western New York, Charles L. Foster, The Arcade, Cleveland.

Fig. 1—General view of No. 1 Shop. It is unusually well supplied with cranes. The hopper in the left foreground is part of the sand mixing equipment

Making Government Castings at Erie

For Economy and Efficiency It Has Been Found Desirable to Separate the Different Castings Made Into Two Classes and to Handle Each Class as a Unit

BY PAT DWYER

UNDER the stress of war, many manufacturers in the United States engaged in making ordnance for the government successfully met specifications which they previously had declared to be impracticable, if not impossible to follow. Working at high pressure, engineers, works managers, superintendents and foremen solved numerous problems which previously had given trouble, and in doing so helped to raise manufacturing in the United States to a higher standard. This is particularly true of the steel casting industry, in which the specifications imposed by the government were extraordinarily severe. The castings for guns and gun parts, which were urgently needed, had to conform to unusually rigid tests which challenged the best skill and resources of foundrymen. The National Foundry Co., Erie, Pa., not only met these tests and specifications successfully but in many cases exceeded them. This foundry supplied, among other items, a large number of yokes for 16-inch guns. Test pieces taken from the cope side of these castings showed the following properties: Tensile strength, 103,500 pounds; elongation, 24 per cent; elasticity, 72,500 pounds; reduction in area, 54 per cent; and deflection, 120 degrees. The chemical analysis of the steel was carbon, 0.30 per cent; manganese, 0.74 per cent; phosphorus, 0.04 per cent; sulphur, 0.032 per cent; silicon, 0.319 per cent; nickel, 2.13 per cent. The property of the company on which the foundries are situated cov-

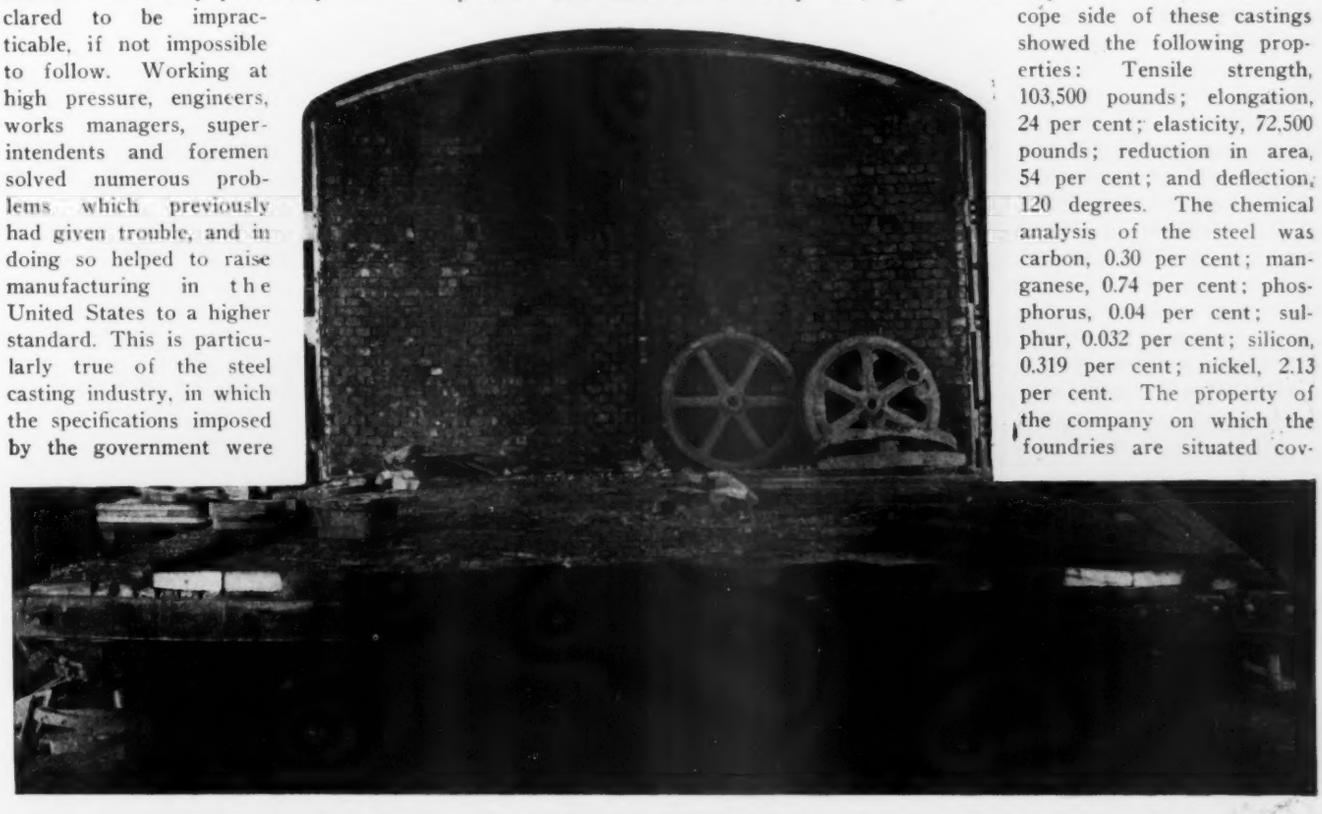


FIG. 2—ANNEALING CAR WITH OVEN DOOR ATTACHED TO THE OUTER END—THE CAR IS SUPPORTED ON SIX WHEELS AND HAS A CAPACITY OF 148 TONS

FIG. 3—CORE ROOM WHERE SMALL CORES ARE MADE—THE CORE OVEN AT THE BACK HAS A DOOR IN THE SIDE AS WELL AS IN THE END

ers an entire city block of 350 x 660 feet. It is served by spurs from the New York Central; the Nickel Plate and the Bessemer & Lake Erie railroads. A large floating, balanced scale, having a capacity of 240,000 pounds, is located on the main track near the middle of the plant and is used to weigh incoming and outgoing carloads of materials and castings. Power for operating the plant is purchased from the city and enters the power house over two distinct lines from two streets. Only one of the lines is utilized at a time, the other being an insurance in case of accident from any cause. The same idea is carried out in the power house where everything is duplicated. There is one, two-stage compressor made by the Ingersoll-Rand Co., New York, with a capacity of 2200 feet per minute, one compressor manufactured by the Bury Compressor Co., Erie, Pa., having a capacity of 1000 feet per minute; and one compressor, made by the Nagle Corliss Engine Co., Erie, also with a rated capacity of 1000 feet. The large compressor forms one unit and the two smaller ones the other. In this building are also situated in duplicate the generator sets for the cranes, and the pumps for supplying oil to the furnaces.

Large Stock of Supplies

The brick storage is situated between the power house and the main foundry building. A stock of brick is constantly kept on hand, sufficient to completely rebuild a furnace. Tanks for holding the oil used for fuel are submerged in various parts of the yard. They have a combined capacity of 155,000 gallons, this being a little over the average consumption of the two furnaces for a month's operation. In this plant it has been found economical to divide the castings into two general classes, according to weight. For that purpose all the castings which weigh 100 pounds or less are made in one building and the heavier castings in another. Each foundry has its own furnace, core room, annealing oven and cleaning room and is treated as a unit. Separate records are kept covering the operations of each foundry. The small shop turns out from 85 to 100 tons of castings per month and the large shop from 800 to 1000 tons. Although the shops are separate, they work in conjunction to a certain extent by exchanging molten metal when necessary. This is accomplished by attaching a buggy ladle to a tractor built by the Automatic Transportation Co., Buffalo. When not engaged in transferring molten metal from one shop to the other the tractors are used for general utility purposes around the shops and yard. All the castings were made in No. 1, or the main shop until 1916,

FIG. 4—DRAG MOLD FOR BASE OF 16-INCH NAVAL GUN—THE CASTING IS POURED ON AN INCLINE FROM A BOTTOM GATE

when it was decided that better results could be obtained by segregating the work and making all the light castings in a separate building. In order to carry out this idea, a building was taken over and fitted up for a foundry. A 5-ton, oil-fired, open-hearth furnace was built and all the other necessary equipment bought, built and installed, including a 7½-ton traveling crane built by the Case Engineering Co., Columbus, O.; two 6 x 10 x 24-foot core ovens for drying the molds; one oven for drying cores; a 4 x 5 x 15-foot annealing oven, and a roller and pan grinder built by R. Wetherel, Chester, Pa., for mixing facing and core sand. A large tumbling barrel built by the company, and stationary and swinging grinding wheels are employed in the cleaning room. All the government work is dipped into a pickling tank before sandblasting.

CUSTOMER		FDRY No.
PATT. No.	SECTION No.	SHELF No
CORE BOXES	LOOSE PIECES	CONDITION
DATE REC'D	DATE RET'D	CONDITION
REMARKS		
ORDER No	DATE	No. REQ'D

FIG. 6—PATTERN RECORD GIVING INFORMATION RELATIVE TO THE CLASSIFICATION OF THE PATTERN PIECES AND COREBOXES TOGETHER WITH INDEXING DATA—A DUPLICATE IS KEPT IN THE OFFICE

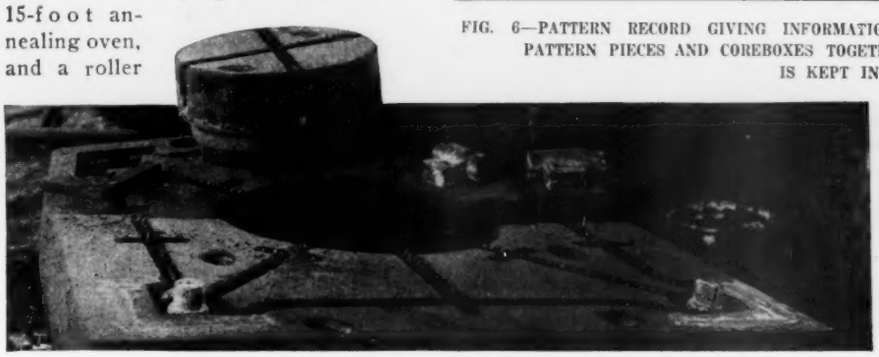


FIG. 5—THE CORNER OF ALL BRACKETS ARE FILTERED AND ROWS OF NAILS INSERTED

Economical Heating System Installed

An ingenious system of heating the shop by utilizing the heat radiated from the roof of the furnace was described in the June 15 issue of THE FOUNDRY.

Some of the work in this shop is made in green sand and some in dry sand, depending altogether on its character. Everything is poured through an 1½-inch nozzle from a 5-ton bottom pour ladle.

In order to avoid the jump of flame at the nozzle of the oil burners in the furnace incident to each stroke of the pump supplying the oil, an accumulator in the shape of a cylindrical tank has been constructed immediately back of the charging floor. A pump keeps this tank full of oil. Air is admitted to the top of the tank at 90 pounds pressure and this forms a cushion to absorb the shock. The result is that oil is fed to the burners in a steady stream and this makes an absolutely uniform flame. The pump is controlled automatically. When there is a certain amount of oil in the tank it stops and when the pressure backs down to a certain predetermined point it starts up again.

The shop which is devoted to the heavy work is 125 x 400 feet. Adjoining it and opening into it at one end is the chipping and cleaning room, 110 x 250 feet. A general view of the main interior is shown in Fig. 1. The shop is well supplied with cranes, there being four electric traveling cranes each with a 71-foot span. Three of these are of 30-ton capacity each and were

ESTIMATE SHEET

Customer

Casting Pattern No. B-P No.

Flask Length Width Cope Sect. High Drag Sect High

Flask Dia " " " " " "

Department	Moulding Hrs.	Moulding Rate	Moulding Amount	Helping Hrs.	Helping Rate	Helping Amount
Green Sand Moulding						
Dry Sand Moulding						
Dry Floor						
Coremaking						
Chipping						
Burning off						
Grinding						
Finishing						
Welding						

Head	Dia. x	Long	Weight of Casting lbs.
"	"	"	No. Required
"	"	"	Per cent Loss
Gate	"	"	Production Required
"	"	"	

Remarks

Foundry No.

FIG. 7—ESTIMATE SHEET OF TIME AND COST OF JOB

National Foundry Company
DAILY CAST REPORT

Date _____ Tapped _____ M. Slagged _____ M. Heat No. _____

No. Piece	Name of Casting	Pattern Number	Weight Each	Total Weight	Customer	Worker No.

FIG. 8—ONE COPY OF THIS FORM IS FOR THE FOUNDRY OFFICE, ONE FOR THE CLEANING ROOM AND ONE FOR THE MAIN OFFICE

supplied by the Morgan Engineering Co., Alliance, O. The fourth has a lifting capacity of 15 tons and was built by the Erie company. In addition to the main hoist each of the cranes is equipped with an auxiliary hoist of 5-ton capacity. In addition to the traveling cranes there

National Foundry Company

Foundry No.

Customer

Destination

Our Order Date Customer Order No.

No. Reqd. Pattern Drwg.

Description

Sent to Foundry Average Wt.

Promised Spec.

Moulded		Cast		Scrap		Shipments	
Date	Amount	Date	Amount	Date	Amount	Date	Amount

Totals

Note-This Record Must Not Be Destroyed.

FIG. 9—DATA REGARDING CUSTOMER'S ORDER

is a jib swinging from every other column, each one of which carries a light electric hoist.

Grab buckets which are carried from place to place by the cranes are used largely for handling the sand. The large flasks are filled in this way and sometimes if the crane happens to be close, a bucketful is dumped into a small flask. In either case, the sand is spread out with a shovel before the molder commences to ram. The ramming is done with air rammers, except the final butt, which is accomplished with butt rammers six inches in diameter at the base.

The pans for mixing the core sand and facing are located one on each side of a central hopper. The hopper has a capacity of 30 tons and is loaded by means of one of the grab buckets. A chute at the back of the hopper at the bottom directs the sand on to a power operated riddle which removes all the scrap, gaggers, rods, etc., and lets the sand fall into a pit. Here it is fed by a screw conveyor onto an elevator which conveys it into a second hopper with chutes leading down on each side to the mixing pans. One of these is a 6-foot pan made by the American Clay Machinery Co., Bucyrus, O., and the other is an 8-foot pan made by the National Engineering Co., Chicago. Each unit may be worked independently or in parallel as desired. The pans discharge on the side nearest the cranes. By this arrangement the cranes can drop a grab bucket in the pile of facing or core sand any time and carry it wherever it is needed.

The small cores are made in the core room shown in Fig. 3, and dried in the drawer oven shown in the background. The larger cores are made on the molding floor adjoining the core room and dried in one of the large ovens. Some machines are used and the men are supplied with air rammers. Small rammers are used by the bench men and those of regular molders' size are provided for the men on the floor.

Some of the molds in this shop are poured green, but most of them are dried. There are four large ovens each 10 x 10 x 40 feet. The cars are pulled in and out of the ovens by the crane. A cable hooked on the back of the car and passing through a sheave attached to a bolt in the back wall of the oven serves to pull the car in; while a cable hooked on to the front of the car and passing through a sheave anchored to a "deadman" at the end of the track pulls it out.

At present the ovens are heated by coke but it is proposed to do away with coke and substitute waste gas from the furnace stack. Mr. Willis, the works manager has convinced himself by a series of experiments that the plan is entirely feasible and is now engaged in connecting the ovens to the stack by a line of permanent piping. The pipe is lined with brick to an inside diameter of 12 inches. The same flues will be left in the ovens, the only alterations necessary being to brick around the pipe where it enters the former fire hole.

The steel is melted in this shop in a 20-ton, acid-lined, open-hearth furnace operating on oil fuel. The furnace is charged with cold stock by hand. The average time of a heat is 7 hours. As an evidence of the skill displayed in manipulating the furnace, it is claimed that between 1100 and 1200 heats are taken off before the roof is rebuilt.

The 22-ton ladle into which the furnace is tapped has a 6-inch hole through one side about a foot from the top. There is a short spout on the outside. This arrangement is for the purpose of letting some of the steel overflow into a smaller ladle alongside when the furnace is tapping. After the furnace is empty the small ladle is either taken over to No. 2 shop, used to pour some of the small work in No. 1, or used to back up the large ladle in the case of an exceptionally heavy casting.

After the castings have been

National Foundry Company
FOUNDRY REPORT
Castings Moulded Daily

Date _____ Foundry _____

DRY SAND MOULDING DEPT.

Emp. No.	Day Work Hours	Piece Work Hours	Piece Work Rate	No. Pcs. Moulded	Name of Casting	Pattern Number	Worker No.	Weight Each	Total Weight	Customer

IN PROCESS OF BEING MOULDED

FIG. 10—ONE COPY OF THIS FORM REMAINS IN THE FOUNDRY OFFICE AND ONE COPY GOES TO THE MAIN OFFICE

NATIONAL FOUNDRY COMPANY—Pattern Production

Customer	Pattern	Description	Remarks	Date	Ordered by	Date Completed	No. 1	No. 2	Material	Amount	Clock No.	Hours	Preference

FIG. 11—PATTERNSHOP COSTS ARE MADE UP FROM THIS SHEET WHICH IS 11½ x 8½ INCHES

chipped and cleaned and the risers cut off with oxyacetylene they are piled on the special car shown in Fig. 2. This car is supported on 6 wheels running in roller bearings, is 14 x 27 feet, and has a capacity of 148 tons of castings. The door of the annealing oven is attached to the car. The oven and car were designed and built by Holcroft & Co., Detroit, in collaboration with the engineering staff of the National Foundry Co. A special electric hoist has been provided for pulling the car in and out of the oven. The oven is 10 x 14 x 27 feet and is heated with oil. A channel iron built into and projecting from the wall at the height of the car along both sides is kept filled with sand and a projecting flange on each side of the car slides along in the sand as the car passes into the oven and acts as a seal.

All of the castings made by the National Foundry Co. are annealed. They are given different heat treatments according to the requirements they must meet. To illustrate the effect and importance of proper heat treating it may be mentioned that some of the castings must be treated several imes before the desired result is obtained.

The chipping room is equipped with two 15-ton cranes, one built by the Niles-Bement-Pond Co., New York, and one by the Erie Steel Construction Co., a sand blast outfit supplied by the Pangborn Corp., Hagerstown, Md.; pneumatic chipping tools and stationary and swinging grinding wheels. Adjoining the cleaning room is a testing room and repair shops. There also are machine and blacksmith shops, and a special room where all the pneumatic appliances are repaired and stored when not in use.

The disposal and removal of waste and burnt sand from the cleaning room which is more or less of a problem in every steel casting shop, is taken care of very simply in this plant. Twice a day one of the tractors already referred to makes a round of the cleaning room pulling a side dump car behind it. All the loose sand is shoveled into the car which is then hauled out into the yard and dumped into a concrete pit which has a capacity of 30 railroad car loads. One or two cars are backed up to the pit at convenient intervals and loaded with the refuse by the aid of a grab bucket hanging from a 10-ton yard crane. This crane, built by the Erie Steel Construction Co., has an 85-foot span and besides handling the refuse it carries the stock to the charging platform of the furnace; loads and unloads all kinds of material in and from cars and also lifts the drop ball when breaking scrap.

The sand bins, which have a capacity sufficient for two months' sup-

DEFECTIVE REPORT

NATIONAL FOUNDRY CO. Date _____

				Shift	Scab	Dirt	Core Blow	Miss Run	Run Out	Slag	No. Good Cstgs.	No. Bad Cstgs.	Weight

Remarks

Foreman

FIG. 13—REPORT ISSUED DAILY BY CLEANING ROOM CLERK. ONE COPY IS RETAINED, ONE GOES TO THE FOUNDRY OFFICE AND ONE COPY TO THE MAIN OFFICE

Date _____

_____

Gentlemen:

We herewith hand you weekly statement showing condition of your various orders:

Date of Order	Order No.	Patt. No.	No. Reqd.	No. Cast	Due ... Mold	No. Shipped	Remarks

FIG. 12—WEEKLY FORM SENT TO CUSTOMERS ADVISING THEM OF THE PROGRESS OF THEIR ORDERS. THE FORM IS 8½ x 11 INCHES

ity sufficient for two months' sup-

FIG. 14—THE STOCK IS KEPT IN PLACE BY A SUBSTANTIAL RAIL AND PLANK FENCE. THIS DEVICE ADDS TO THE APPEARANCE OF THE PLACE AND ALSO PREVENTS ACCIDENTS

ply, are located in one corner of the main building and back of the sand mixing apparatus. The yard crane lifts the sand out of the cars with a grab bucket and drops it into the bins through hatchways in the roof of the building. Silica flour and fire clay which can not be exposed to the weather are shipped in box cars and must be unloaded with wheel barrows. These supplies as well as dry core compound in bags are all kept in the same section of the building as the sand. A concrete retaining wall 10 feet high by 24 inches in thickness holds the material in its place, while 12-inch walls running at right angles to, and connecting the retaining wall to the main wall of the building, help to separate the different kinds of material from each

The flasks and the core oven cars are of cast steel and were made by the company. The rectangular flasks, which are made in sections and bolted together, are heavily flanged and ribbed. The bars in both round and rectangular flasks are bolted in.

Foundry Yard is Neat

In most steel plants the boxes used for carrying scrap, slag, etc., are made of steel plate but in this foundry they are of cast steel having an average thickness of one inch. Another innovation is the method adopted for maintaining an orderly and well kept scrap yard. This is clearly shown in Fig. 14. Short pieces of scrap rails were stood up in a row of holes about four feet from the railroad track and the holes were filled with concrete to anchor the rails firmly in their places. The planks forming the retaining wall were attached to the upright rails with spikes having their heads bent around the flange of the falls.

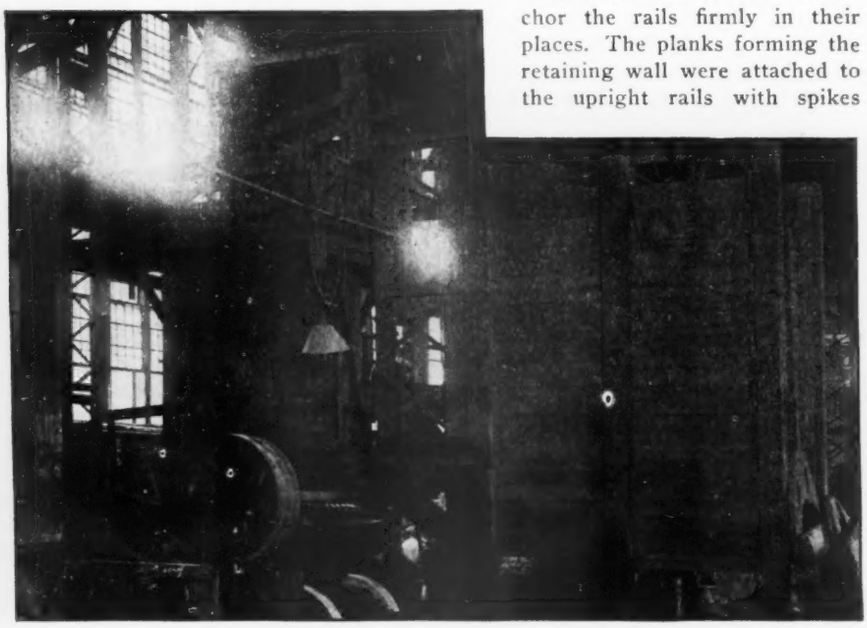


FIG. 15—DUPLICATE SETS OF SAND MIXING EQUIPMENT ARE PROVIDED

In order to be in a position to bid intelligently on new work the company maintains a small building near the pattern shop for conferences of department foremen. When an inquiry is received the foreman patternmaker takes the blueprint and lays it out full size on a board in this building. The heads of all departments meet together and estimate the time it will take each to do his share and also the amount of steel required to be melted. Unusual designs, difficult sections to cast and other problems which frequently confront the steel foundryman are pointed out and remedies suggested before the job is started. As a result of the conference the form shown in Fig. 7 is made out by the production office and sent to the sales office. The sales manager bases his quotations on the data thus supplied. At stated periods and as a matter of the greatest importance, the actual costs are checked against the estimated costs. Furthermore, since a complete record is kept, after a time it becomes a comparatively simple matter to estimate on new work. In the accumulated data there is precedent for nearly every type of work.

When an order is received two sets of cards are made out and also six small photographic prints. One card, 5 x 6 inches, Fig. 6, is made out in duplicate and a print pasted on the back of each. One copy goes to the pattern shop record and the other is kept in the office of the production manager. The photographs serve as silent witnesses to the exact condition of the pattern when

DATA ON BELTS AND PULLEYS

By W. L. Tryon

Size of Belts

If the required horsepower is given, from the information already presented the cross sectional area required may be obtained. For this area different thicknesses or widths may be chosen, the other dimension depending upon these factors.

If the width of pulley is given, then the belt width is obtained from table following. Then in Data Sheet No. 312 note this width in the first column. Opposite this find the area nearest to the area required, and at the top of the column will be the required thickness.

Width of Pulley	Width of Belt
1½ to 3½ inches	width of pulley minus ½ inch
4 to 6¾ inches	width of pulley minus ¾ inch
7½ to 13 inches	width of pulley minus 1 inch
14 to 24½ inches	width of pulley minus 1½ inches
26 to 40 inches	width of pulley minus 2 inches
42 inches and above	width of pulley minus 3 inches

Another condition affecting the size of belt is the diameter of the smaller pulley as a thick belt running over a small pulley will crack. Therefore a double belt should not be used on a pulley less than 10-inch diameter or a three-ply belt on a pulley less than 18 inches in diameter. The thickness of a single ply belt is approximately 1/6 inch, of standard double 1/3 inch, and of three-ply belt, 9/16 inch.

If the pulley width is not given, then the dimensions of the belt may be chosen and the pulley width made to suit. In this case the thickest standard belt possible is chosen, that is, single belts for pulleys under 10-inch diameter, double belt for pulley 10-inch diameter up to 18-inch diameter, and three-ply belts for pulleys 18-inch diameter and up, as narrow thick belts are more durable than wide thin belts. The width of belt is then determined from the cross sectional area table, using the thickness chosen and the area required for given horsepower.

Note—This sheet may cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

DATA ON BELTS AND PULLEYS

By W. L. Tryon

Width of Pulley

The width of pulley should be greater than the belt width by the following amounts:

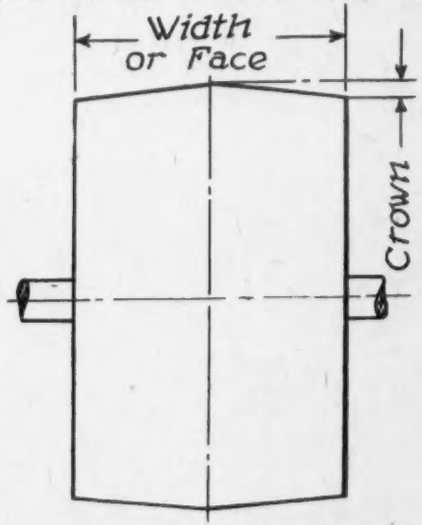
Width of Belt	Width of Pulley
1 to 3 inches	Width of belt plus ½ inch
3¼ to 6 inches	Width of belt plus ¾ inch
6½ to 12 inches	Width of belt plus 1 inch
13 to 23 inches	Width of belt plus 1½ inches
24 to 38 inches	Width of belt plus 2 inches
39 inches and above	Width of belt plus 3 inches

Economical Speed for Belting

The most economical speed of belting is between 4000 and 4500 feet per minute.

Direction of Belt

The thin edge of all laps and splices on the side of the belt next pulley should point away from the pulley which the belt is approaching. The hair side of the belt should run next to the pulley.



Crowns for Pulleys

Width or Face (Inches)	Crown (Inches)
2 to 2½ inclusive	1/32
3 to 5 inclusive	1/16
5½ to 8 inclusive	3/32
9 to 12 inclusive	1/8
13 to 20 inclusive	5/32
21 to 28 inclusive	3/16
29 to 40 inclusive	1/4
41 to 50 inclusive	9/32

Arrangement for Pulleys

Machinery driven from overhead shafts should be so placed that the belt will make an angle from the vertical of not less than 45 degrees. The driving and driven pulleys never should be in the same vertical line, if it is possible to secure other arrangement.

THE FOUNDRY DATA SHEET, DECEMBER 15, 1919
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

received, and again later, the record on the face of the card shows how many castings have been made, justifying, if necessary, the company's claim for supplying a new pattern or a charge for repairing the old one.

The card shown in Fig. 9 is 5 x 8 inches. It furnishes the production manager with exact, easily accessible information on every essential item connected with each job. It is made out in quadruplicate and a copy of the photograph is pasted on each. All four copies are sent first to the pattern shop where one copy is retained until the job is actually under way. One copy goes to the foundry office, one to the cleaning room foreman and one to the shipping clerk. After the pattern has been taken to the foundry and all the cards distributed the pattern clerk fills in the date and sends the first card back to the production manager's office. Here the spaces above the double lines are filled in, and when production starts, the lower columns are filled with data taken trom the daily foundry report sneets which are shown.

These sheets are self explanatory. Fig. 8 is made out in triplicate, one copy being retained in the foundry office, one going to the cleaning room foreman and one to the main office. Fig. 10 is made out in duplicate. One copy is for the foundry office and one for the main office. In addition to these forms another form, Fig. 13, which is made out by the cleaning room clerk, shows the number of defective castings from each heat and also the cause. It is made out in triplicate, one copy being retained in the cleaning room, one copy sent to the foundry office and one copy placed on file at the main office of the company.

A copy of the form shown in Fig. 12 is sent to each of the principal customers weekly and gives them a summary of the condition of their orders.

The pattern clerk keeps a record of patternshop operations on the form shown in Fig. 11. The production manager, with the knowledge gained from the forms shown in Figs. 6 and 9, indicates in the column marked "preference" which jobs are to have precedence.

It is the aim of the management to promote a feeling of harmony and co-operation between the men and the company. To that end the men were asked some time ago to name committees from the different departments to meet representatives of the company twice a month, to have supper together in the company's restaurant and talk things over. The first few meetings were not productive of results; the men apparently being diffident in the presence of authority. The manager called a general meeting of the men and told them to elect a new committee composed of men who were not afraid to speak their minds. He assured them that the company was absolutely in favor of a square deal and he wanted the men to realize that fact.

Since that time results have been gratifying. Grievances and knotty points touching on prices and shop conditions have been thrashed out at these gatherings in a free and open manner. The management encourages the men to do their best and shows appreciation by increased remuneration. The work is all made on a piece work basis, the molders wages averaging $9 a day.

Besides the lunch room already referred to, the company has built a garage to accommodate the cars of its employes.

Hold Joint Meeting

A meeting of the Newark Foundrymen's association, Newark, N. J., which was held Dec. 3, was participated in by the membership of the Gray Iron club and the Metropolitan Brass association, of New York. The object of the meeting was to bring the foundrymen of the Newark and New York districts closer together.

This was the first gathering of the kind ever held jointly by the three societies, and owing to its success the meeting probably will be repeated. A. E. Barlow, president of the Newark Foundrymen's association presided, introducing Andrew N. Petersen, president of the Gray Iron club and Frederick H. Landolt, president of the Metropolitan Brass association who made brief addresses. It was proposed by Mr. Petersen that the 1921 convention of the American Foundrymen's association, with its exhibition of foundry equipment and supplies, be scheduled for Newark or some other community in the New York district. This proposal, offered as a resolution, was adopted unanimously.

A. O. Backert, editor of THE FOUNDRY was the speaker of the evening, and addressed the foundrymen on the foundry industry in France and England as seen through American eyes. Mr. Backert pointed out that whereas steelmaking capacity in this country has expanded at the rate of 10,000,000 tons a year, the pig iron production has remained almost stationary. He stated that this great demand for steelmaking iron has caused the increased prices and will continue to cause further advance. The speaker contrasted foreign with American foundry practice and enumerated the conditions which must be considered in making a fair comparison. He stated that the casting industry in France is not as large at the conclusion of the war, as it was previous to the German invasion, for the foundries gained through the accession of Alsace-Lorraine have been outnumbered by those destroyed by the enemy. In England the industry has expanded until now the foundries of that country number over 3000 active foundries.

Irregular Melting

By H. E. Diller

Question.—Since our output has decreased and we melt only 2000 to 3000 pounds of metal a day we are getting hard iron in the first of our heat, although we use the mixture which formerly gave us soft iron. We have a 36-inch cupola. Is this too large, or what is the trouble?

Answer.—There is no reason why 2000 pounds of iron cannot be melted in a 36-inch cupola without detriment to the iron. When relining the cupola, however, it might be well to line it down to 30 inches.

From the limited amount of information which you give it is impossible to say exactly what causes the hard iron at the first of the heat. We would suggest you be sure the coke bed is high enough. To start with it should be 30 inches above the tuyeres. Later when you get good iron you can cut this down somewhat. Divide your iron into 1000-pound charges with 120 pounds of coke between each two charges. You should also be able to cut this down later. Then do not tap out until the first 1000 pounds of iron is melted. This will give a more thorough mixture than if you tap and pour before the entire charge is melted.

If the foregoing precautions do not give you soft iron, you should send a sample of the iron to a chemist and have him analyze it for silicon and sulphur. Too little silicon or too much sulphur will cause hard iron.

The Columbia Iron Works, Columbia City, Ind., recently has completed a new foundry for the manufacture of brass, aluminum and gray iron castings. Oscar F. Menefee is manager.

The Link-Belt Co., manufacturer of drive chain and labor-saving machinery, will install a new furnace at its Indianapolis plant.

Castings for Ship Construction-XVI

Details of Methods for Molding Stern Frame Castings are Considered—Three Drawbacks are Provided and Ways of Handling Them are Described—Slanting the Mold Not Considered Advisable

BY BEN SHAW AND JAMES EDGAR

AMONG the difficult castings used in ship construction is the stern frame. Owing to the special function of the stern frame it is imperative that a sound casting be produced for this part. This condition is especially essential when, besides being a support for the rudder, the casting provides the aperture for the tail-end shaft and supports the weight of the propeller, as in the case of a vessel with a single screw. The unwieldy nature of this type of casting, and the varying thicknesses of metal encountered in the designs, together with the cross stiffeners used, all assist in making the preparation of the mold difficult. When equipment is available it is better to use flasks, for the greater convenience permitted in drying and in pouring. It is only on rare occasions that the molds can be arranged for pouring vertically, but an advantage often may be obtained by slanting the mold so that some parts get a better head of metal. This produces a greater pressure and ensures denser metal where more strain is likely to occur in the casting. Not infrequently however, the size and general awkwardness of the design leaves the foundryman no alternative other than to use the foundry floor to form the drag. There is not the same freedom for running the job when the floor is used, still it gives opportunity for slanting the mold. While this method may be adopted, it is much more inconvenient to work and the slant must be comparatively small, and will thus afford little advantage. Taking into consideration the extra work involved in the process, the practice of slanting the mold cannot be recommended for this type of casting.

The example under consideration is, as was said when dealing with the patternmaking, one of the more general types used in the construction of light warships, and the methods described and illustrated cover the more common practice for this particular form.

When a pattern is made the mold can be formed in a two-part flask, but it is not very convenient to do this. The shape about the rudder post support and the rudder stopper can be made more conveniently by cores, and would appreciably reduce the work in the foundry; but the remainder of the mold is preferably left so that suitable drawbacks can be made. The pattern, being in halves, is of a fragile nature and careful handling of it is necessary. A level bed is prepared and half of the pattern is laid on it as shown in Fig. 1. It is better to make up the prints for the drawbacks before the drag flask is set over the pattern, although many foundrymen prefer to cut them out after the flask is rammed and rolled over. The inside of the frame should be packed with bricks as much as possible to give a good support to the web when ramming the bottom, and to form the space for the drawbacks. The same process is required with that part of the frame which is concentric with the rudder, since the pattern cannot be withdrawn satisfactorily without a separate lift to overcome the difficulty of the curve. The screws securing the stiffening ribs are removed and parting sand is applied, preparatory to lowering the flask.

Trouble is avoided by fixing a few screw eyes into the pattern at convenient places just high enough to project above the flask. Then, after the box has been rammed, the pattern can easily be made secure before rolling it over. This method of preparing the drag is by far the best. The work is easier, the sand is more readily consolidated, and a truer shape is more likely to be attained with less rough usage to the pattern. When it is not convenient to adopt this method, the bedding-in process is used, but, instead of making the joint of the pattern flush with the foundry floor, the work in the top flask can be reduced by sinking the job until the highest part of the pattern is level with the floor. This removes the necessity of special flask bars. A similar bed is prepared, but at a depth below the floor level equal to half the highest part of the pattern as shown in Fig. 2. A rough shape of the pattern

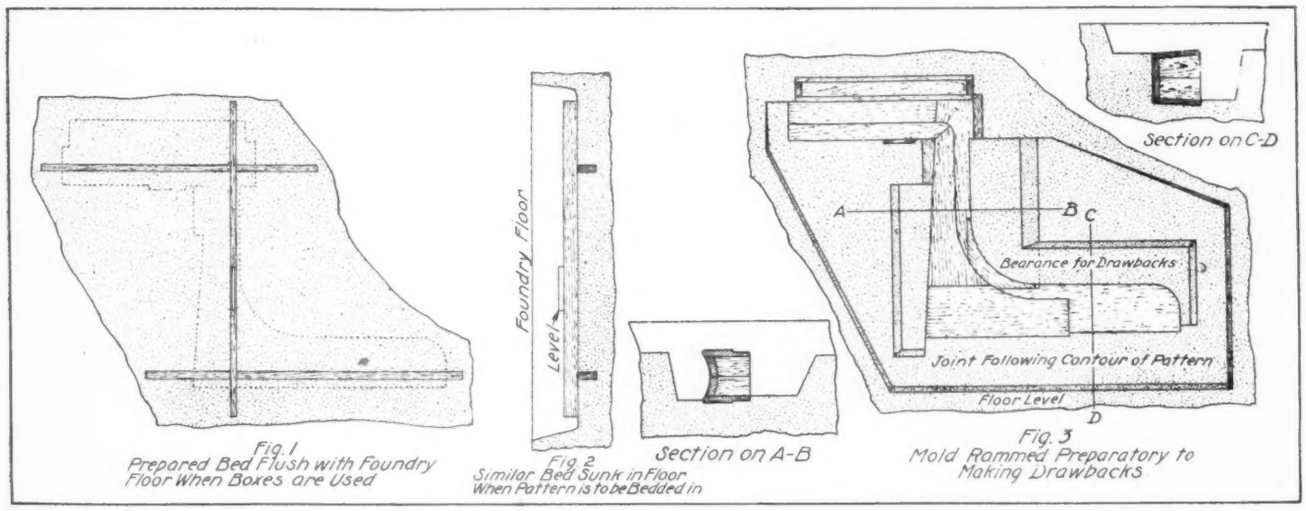


FIG. 1—PREPARED BED MADE FLUSH WITH FOUNDRY FLOOR WHEN FLASKS ARE USED FIG. 2—BED SUNK IN FLOOR WHEN PATTERN IS TO BE BEDDED-IN FIG. 3—MOLD RAMMED PREPARATORY TO MAKING DRAWBACKS

is marked on the bed and the sand is cut out for lowering the pattern. Stout battens should be secured to the joint of the pattern to maintain its rigidity and to hold it flush with the top joint, when the pattern is set in position. The sand at the sides may be removed to allow the molder access to the bottom of the pattern when tucking the facing sand around it. This must be done carefully to retain the true shape. When a number of seats have been made, the pattern is lifted and the bottom screws removed from the stiffening ribs. It is then returned to its position for final molding. The battens are removed and the surface is tried with a parallel straight edge and a spirit level. A seat is made up for the drawbacks marked *A* and *B* in Fig. 4, about the inside of the frame and following along the inside surface of the web.

On the outside and below the print for the stopper core, a seat is formed off the pattern for the drawback *C*. Much of the sand about these places can be rammed before the top half of the pattern is placed. Boards are set up to give a good taper to the required drawbacks and the sand is rammed against them. It will be noticed that a considerable taper is given to the sides for the drawback *A* which is made to follow the dotted line as shown in Fig. 4. This leaves clearance in stripping from the convex part of the pattern. When the sand has been rammed high enough, the other half of the pattern is placed and a weight used to hold it in position. The ramming is continued until the sand reaches the top surface contour of the pattern, forming a joint and tapering up to the floor level as shown in Fig. 3. While this outside ramming is in progress, it is necessary to remove the screws holding the ribs. The general formation of the joints in relation to the pattern are shown in the sections on *AB* and *CD*, Fig. 3.

When the various joints have been made satisfactorily, the drawback, *C*, Fig. 4, forming the concave side of the frame, should be rammed. It is necessary to make this drawback first so that the pattern will be supported when the top web is removed to make the other drawbacks *A* and *B*, Fig. 4. No special care is necessary in the construction of this drawback as there are no contraction difficulties with which to contend. An ordinary form of grid shown in Fig. 5, having a number of prods cast on so that the sand will adhere firmly will suffice for lifting. This grid is bedded in into a seat of facing sand and sand is rammed around it to the contour of the pattern. About 1½ inches of facing sand is placed next to the pattern and backed with floor sand. The top web of the pattern is then removed and preparations are begun for making the other two drawbacks. The stiffening ribs will then be quite loose, so care is necessary to keep them in position while these drawbacks are being formed.

The seat for drawback *A* is prepared with facing sand and the grid shown in Fig. 5 is bedded in position. In this case, contraction must be taken into consideration, and as the grid strengthens the sand so much, the molder should be cautious to form the grid so that it will be well clear of the pattern lengthwise. It should be so molded that the sand separating the ends from the mold will be crushed under the strain when the mold is poured. This drawback should be built up with facing sand to form a hollow box. Ashes are rammed inside to weaken it and reduce the strain on the casting after the metal is poured. A covering of facing sand is given to the surface, the top web bedded in and the joint of the drawback made to correspond with the top contour of the web. The web is removed and the joint for drawback *B* is made up, using a grid similar to that shown in Fig. 5. Instead of using dabbers or prods with these grids, pieces of wrought iron are frequently employed where the strain on the core is likely to be severe, as they give more freely during the time of contraction. The relation of the grid to the drawback is illustrated in the

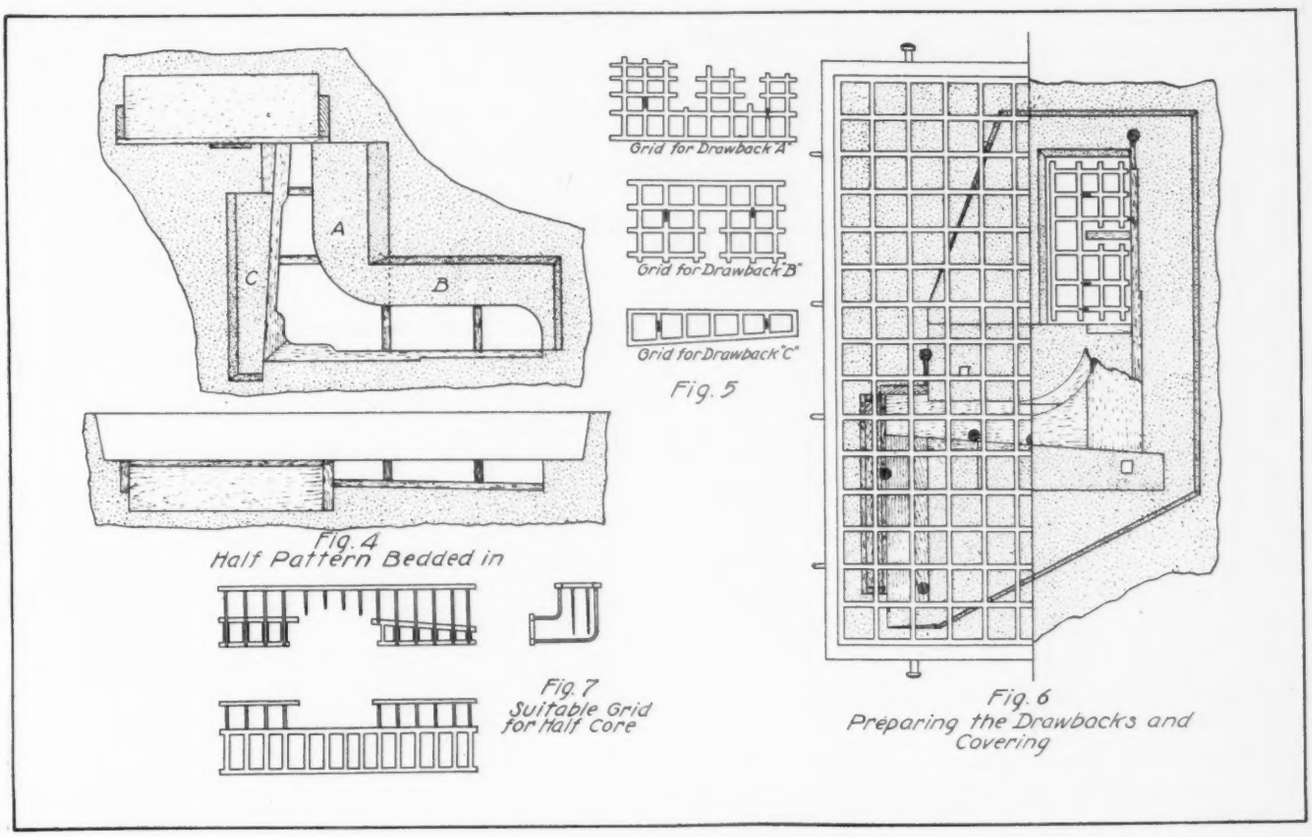


FIG. 4—HALF PATTERN BEDDED IN FIG. 5—GRIDS FOR THE THREE DRAWBACKS FIG. 6—PREPARING THE DRAWBACKS AND CLOSING THE MOLD
FIG. 7—GRIDS SUITABLE FOR THE HALF CORE

illustration showing drawbacks, Fig. 6. During the process of ramming the drag it is necessary to decide on the method of running the job. For work of this character many molders prefer a single gate, with a runner to the end of the mold. The runner is made almost as thick as the full depth of that part of the frame to which it joins. This method of gating is an advantage when all the metal required can be carried in one ladle. However, when a large enough ladle is not available, a supplementary gate is necessary. Such a gate is shown in Fig. 6. The runner can be made to follow up against the drawback, and so need not be flush with the top of the mold.

When the drawbacks have been formed, with the web of the frame in its correct position and pieces of iron plating covering the lifting staples, the top flask is placed in position and the cope is rammed. Gaggers are frequently used to carry the top lift, but so many would be required that it is preferable, especially when the joint is comparatively flat, to cover the mold with facing sand and bed in pieces of grid before the flask is lowered. These grids can then be secured to the flask. Risers are set in where the section of metal is heavier, so that a certain amount of metal can be drawn from them. Their position is indicated on Fig. 6. It is necessary to set a riser over the flange of the rudder post aperture and careful measurement is required to fix its position. Only as much of the cope flask as will ensure a safe lift need be rammed.

While this work is in progress the cores for the top part of the frame, the stopper and the rudder post should be prepared. Though the box for the former is made as one, it is preferable to make the core in two separate pieces for convenience in setting the rudder post core. This makes it necessary to use two grids and, as each part of the core is of a peculiar shape, a special form of grid is required. Such a grid is shown in Fig. 7, having wrought iron pieces bent to shape, with a cast in grid at the ends. Though a little more trouble is caused in forming the grid, it gives very satisfactory results, being light yet comparatively strong. The bottom part of the core, carrying the longitudinal rib is formed up first following the same practice as with the drawbacks in regard to inserting ashes where possible. The other part of the core may be proceeded with at once if paper is used to cover the joint between them. The general appearance of this core, made in halves, is shown in Fig. 8.

When the cope flask is rammed, its position determined, and the gate and riser sticks withdrawn, it is lifted and set on stands, so that the cope is accessible for finishing. The withdrawal of the pattern is then commenced. The loose web on the top is removed temporarily and the drawback, *B*, is lifted, carrying with it one of the stiffening ribs. The removal of this drawback releases the drawback, *A*, which should follow the level at the back when being lifted, in order to clear the convex portion of the pattern. When these two drawbacks have been withdrawn the top web should be replaced. It must be secured well to the rest of the pattern to stiffen the pattern for lifting the top half away. After this part of the pattern is taken out, the drawback, *C*, is free and must be withdrawn to allow the remaining section of the pattern to be stripped. The print for the rudder post core is drawn into the mold, and the mold is prepared for drying.

It is necessary to use a considerable number of nails to strengthen the sand,

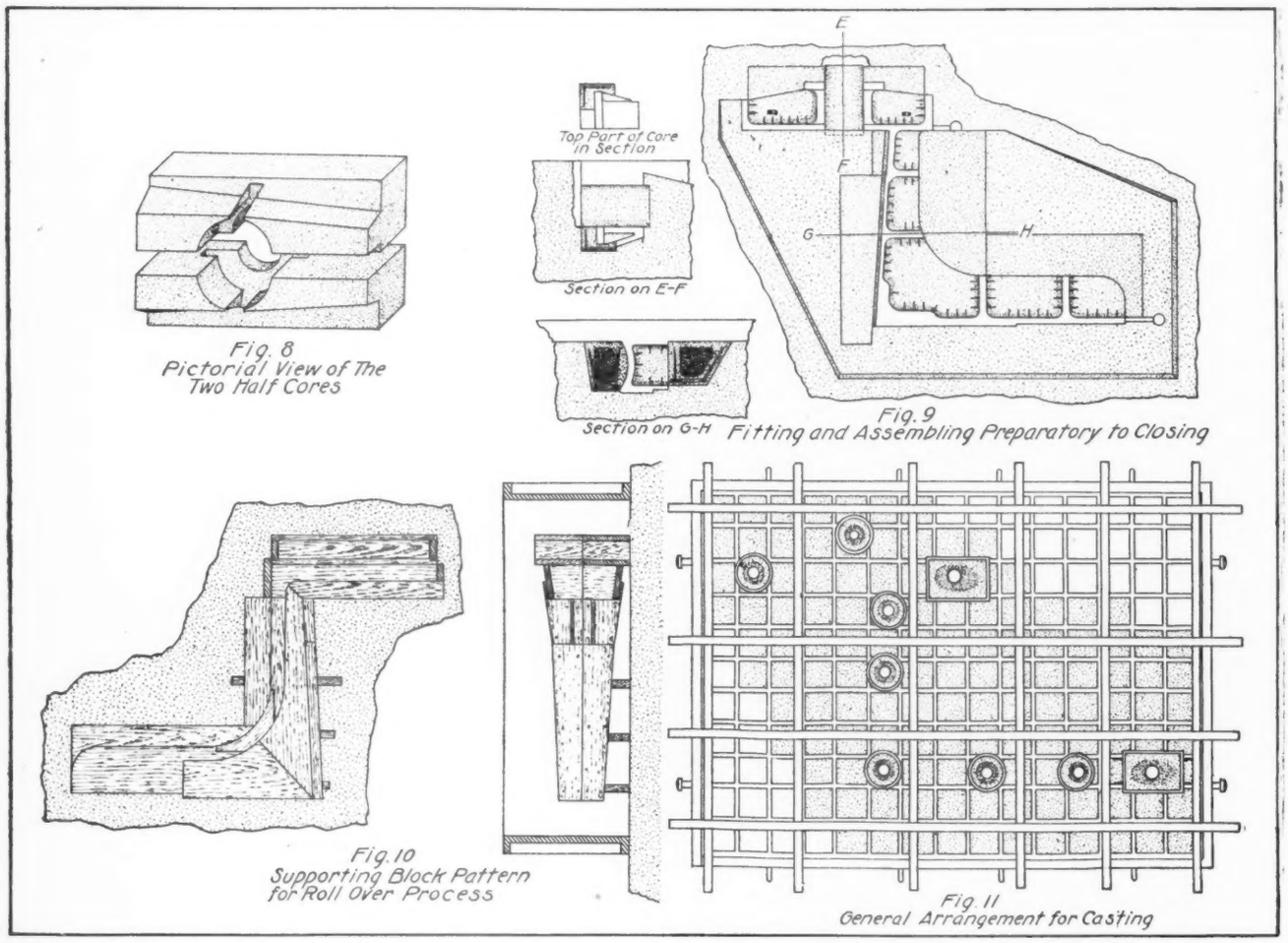


Fig. 8 Pictorial View of The Two Half Cores

Fig. 9 Fitting and Assembling Preparatory to Closing

Fig. 10 Supporting Block Pattern for Roll Over Process

Fig. 11 General Arrangement for Casting

FIG. 8—PERSPECTIVE OF THE TWO HALF CORES FIG. 9—FITTED AND ASSEMBLED PREPARATORY TO CLOSING THE MOLD FIG. 10—METHOD OF SUPPORTING SOLID PATTERN FOR ROLLOVER PROCESS FIG. 11—GENERAL ARRANGEMENT FOR CASTING

especially at projecting corners which are to be left sharp. The sand about the top end should be eased out while the sand is green, to allow the rudder post core to be lowered into its relative position. The two half cores forming the rudder post support, and the two inside drawbacks require special treatment while they are green. Sharp corners, representing the junction between the webs and the body of the casting are rounded off, and besides being well nailed, they should be cut to form small brackets on the casting as shown in Fig. 9. These brackets are most useful in preventing the possible rupture of the casting due to shrinkage. Being only about ¼-inch in thickness they solidify quickly, and in this condition they afford a support in angular sections when the casting as a whole is at the point of solidification.

The core for the rudder post can be made on either a vertical or a horizontal arbor and, since the core is laid horizontally in the mold, the latter method is preferable. Pieces of iron bedded into the core in a line with the arbor, will suffice to stiffen it if they are bound together with wire before the final coat of sand is applied.

The cores and drawbacks can be more conveniently dried in an oven, but it will be necessary to dry the mold in place, with the cope flask supported or suspended over it. When molds, drawbacks and cores are dry, and any cracks which may have formed have been filled up, all those parts with which the molten metal is to come in contact are painted in order to obtain a good surface on the casting. An application of silica wash will give the required result. The surface must again be thoroughly dried after it is painted. Runner and riser basins should be prepared, so that they are ready when the mold is closed for pouring.

In putting the mold together the drawback, *C*, is most conveniently set in position first, as this enables the molder to set the stopper core more accurately. The drawback, *A*, is then lowered into its relative position. To ensure that it will maintain its position when metal is poured into the mold, chaplets are nailed to the web part of the mold, in the bottom and the top of the drawback. These drawbacks take very little time to set. After the staples are covered, hot bricks or iron may be used to dry the sand. The core forming the shape about the rudder post support is more difficult to place.

Preparing Mold for Casting

The bottom half, jointed off the surface of the horizontal rib, is lowered into the recess, then the rudder post core is set in position. A belt slinger is very useful for cores of this kind. It is necessary to move this core to get a support at each end. Then the remaining half core is lowered into its correct position, maintaining the rib thickness by means of a chaplet. Sand is then rammed behind the rudder post core to keep it firm against the shallow print. The general appearance of the mold is shown in Fig. 9. The sections on *E, F* and *G, H* illustrate the relation between the cores, the drawbacks and the mold. With the mold fitted together, and the parts secured where necessary, the cope flask is lowered and preparation is made for casting.

Many foundries prefer a solid pattern for this class of work, because of its greater rigidity. When such a pattern is supplied, either flask may be used for rolling over as shown in Fig. 10 or the bedding-in process may be adopted. In the former instance, instead of setting half of the pattern on a prepared bed, it is better to secure the two halves together and set the whole pattern on the bed, so that when the box is filled with sand and rolled over, the highest part is just flush with the joint. The pattern being comparatively strong is supported, as indicated in Fig. 10, so that its center is parallel to the seat of the drawback. After the pattern is set in position, the joints are made up with bricks and sand to follow the shape of the pattern. It is easier to make up the joint in this way than by cutting it out after the bottom has been rammed.

When a solid pattern is made for a frame of this design, the concave portion and the stopper should be attached so that they can be easily removed. Then they can be drawn into the mold after the main part of the pattern has been withdrawn. The method of procedure would be similar to that already described, excepting that the cores would take the place of the drawbacks. The method of assembling the mold would be similar in every respect. This style of pattern reduces the work in the foundry, and it is to be advocated if many castings are required from the same pattern.

It is usual to cast molds made with solid patterns, on the level. Fig. 11 illustrates the general arrangement. When flasks are used there is the advantage of using bolts to secure the two parts; or bolts are passed through slot holes in the heavy metal bars to be fastened to the drag flask at different places.

Manganese Sulphide Inclusion Takes Form of a Cross

MANY novel structures are shown to the metallographist under the microscope. One of these is illustrated in the accompanying micrographs. In these micrographs which were made by C. I. Niedringhaus, metallurgist of the Mesta Machine Co., Pittsburgh, may be seen an inclusion of manganese sulphide in the shape of a cross. The boundaries of the ferrite are shown in the figure to the right, which is about 100 *magnifications, while the figure to the left is at approximately* 225 *magnifications. The sample was taken from the head of a large nickel steel casting, about half way between the center and the edge and close to a pipe which had formed The composition of the heat of steel from which the casting was made: Carbon,* 0.43 *per cent; silicon,* 0.30 *per cent; sulphur,* 0.036 *per cent; phosphorus,* 0.038 *per cent; manganese,* 0.53 *per cent.*

Malleable Strong in Thick Sections

Center of a 3-Inch Square Bar Has a Tensile Strength of 40,000 Pounds Per Square Inch—Tests of Machined Bars Compare Favorably With Bars Pulled in the Rough

THE feasibility of making malleable iron in heavy sections was shown by W. R. Bean, Eastern Malleable Iron Co., Naugatuck, Conn., in a discussion of papers at the malleable iron session during the recent annual meeting of the American Society for Testing Materials. Results of tests made on a malleable-iron bar 3 x 3 inches in section were given. Tests pieces were cut from this bar at sections shown in Fig. 2 and marked from 1 to 9. These test pieces were turned to dimensions shown in Fig. 3. The test pieces ran lengthwise with the bar and as may be seen from the nine sections illustrated in Fig. 2 every portion of the cross section was represented.

The results of the tests of the nine bars together with the maximum, minimum and average are shown in Fig. 1. From this report it may be seen that the test pieces from the corners of the bar were the strongest as well as the most ductile, ranging slightly over 45,000 pounds per square inch tensile strength. The test pieces from the sides of the bars had a somewhat lower tensile strength, averaging about 43,000 pounds per square inch. The center of the bar, although somewhat weaker than the other portions, gave a tensile strength of 39,859 pounds per square inch, which is credible for iron in the center of such a heavy section of metal. The uniformity of the structure of the metal may be judged from the microphotographs of the nine different sections illustrated in Fig. 4. Little difference is shown in any of the sections except that the temper carbon in the center portion is in larger areas than it is in the other sections.

Data showing the effect of the skin on the strength of the malleable iron also were submitted by Mr. Bean. These consist of tests of tensile bars cast in pairs from 58 furnace heats. One bar was tested in the rough as annealed and the other had a finishing cut taken off before testing. In no case was the amount of metal removed less than $\frac{1}{16}$ inch, $\frac{1}{8}$ inch in diameter, and in some of the tests the amount removed was $\frac{1}{8}$ inch, $\frac{1}{4}$ inch in diameter. There was little difference in proportionate values between bars with $\frac{1}{16}$-inch metal removed and those with $\frac{1}{8}$-inch metal removed.

The following figures show the maximum, minimum and average tensile strength and elongation of the 58 bars tested.

Condition of bars	Elongation per cent in 2 inches	Tensile strength lbs. per sq. in.
	Maximum	
Rough	22.00	58,263
Machined	23.00	60,060
	Minimum	
Rough	8.00	51,333
Machined	8.50	50,241
	Average	
Rough	12.80	53,259
Machined	13.20	53,234

The rough bars were $\frac{5}{8}$ inch in diameter, while some of the machined bars were $\frac{1}{2}$ and others $\frac{5}{8}$ inch in diameter. It will be noted that the minimum elongation occurs on an unmachined bar and that there is little

Form E 91

E. M. I. Co. RESEARCH DEPT., NAUGATUCK WORKS

TEST PIECES FROM: Wilmington Works.

PHYSICAL TEST REPORT No. 432. DATE 3/8/19.

TENSILE BAR							WEDGE BAR				ANALYSIS HARD IRON SHOWN IN BLACK ANNEALED IRON SHOWN IN RED					REMARKS
DATE CAST	FUR. NO.	BAR NO.	DIAM. BAR INCHES	ELASTIC LIMIT LBS. PER SQ. IN.	ELONG. IN 2 INCHES %	TENSILE STRENGTH LBS. PER SQ. IN.	SIZE WEDGE WIDTH BASE INCHES	SIZE WEDGE THICK BASE INCHES	EFFICIENCY BLOW %	EFFICIENCY BUTT %	SILICON %	MAN. %	SUL. %	PHOS. %	TOTAL CARBON %	DRILLINGS FOR ANALYSIS OF ANNEALED TENSILE BARS TAKEN THROUGH BAR NEAR POINT OF FRACTURE
2/6	5	1	.749	32455	12.0	45914					.88	.30	.101	.194	2.24	Test pieces cut from half of
"	"	2	.750	31869	10.0	42870					"	"	"	"	"	3" X 3" X 12" Test Bar.
"	"	3	.750	33318	10.0	45450					"	"	"	"	"	
"	"	4	.750	36215	10.0	43866					"	"	"	"	"	Bar finished all surfaces to
"	"	5	.750	39859	9.0	39859					"	"	"	"	"	remove outer portion or "skin"
"	"	6	.750	36320	11.0	41489					"	"	"	"	"	before being cut into test pieces
"	"	7	.750	34861	12.0	45835					"	"	"	"	"	6" long turned to $\frac{3}{4}$" diameter.
"	"	8	.750	37007	11.0	43707					"	"	"	"	"	
"	"	9	.750	37211	13.0	45631					"	"	"	"	"	Bar was given a normal anneal-
			Max.	39859	13.0	45914										ing at moderate temperature and
			Min.	31869	9.0	39859										cut into test pieces on shaper
			Av.	35678	10.8	43846										with cutting-off tool. Depth
																of cut $1\frac{1}{2}$" proving complete
																annealing and softness through-
																out the section.

FIG. 1

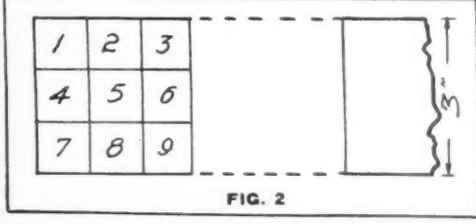


FIG. 2

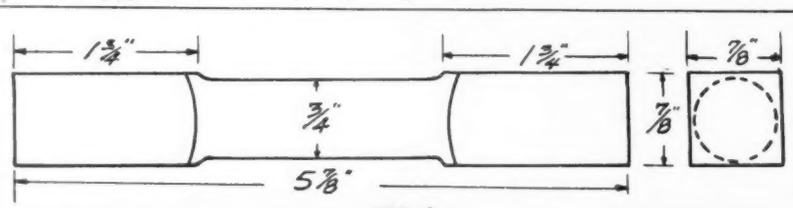


FIG. 3

FIG. 1—REPORT SHOWS RESULTS OF TESTS MADE ON BAR THREE INCHES SQUARE FIG. 2—TEST PIECES WERE CUT FROM THE BAR IN NINE PLACES AS MARKED FIG. 3—SAMPLES WERE MACHINED TO DIMENSIONS SHOWN

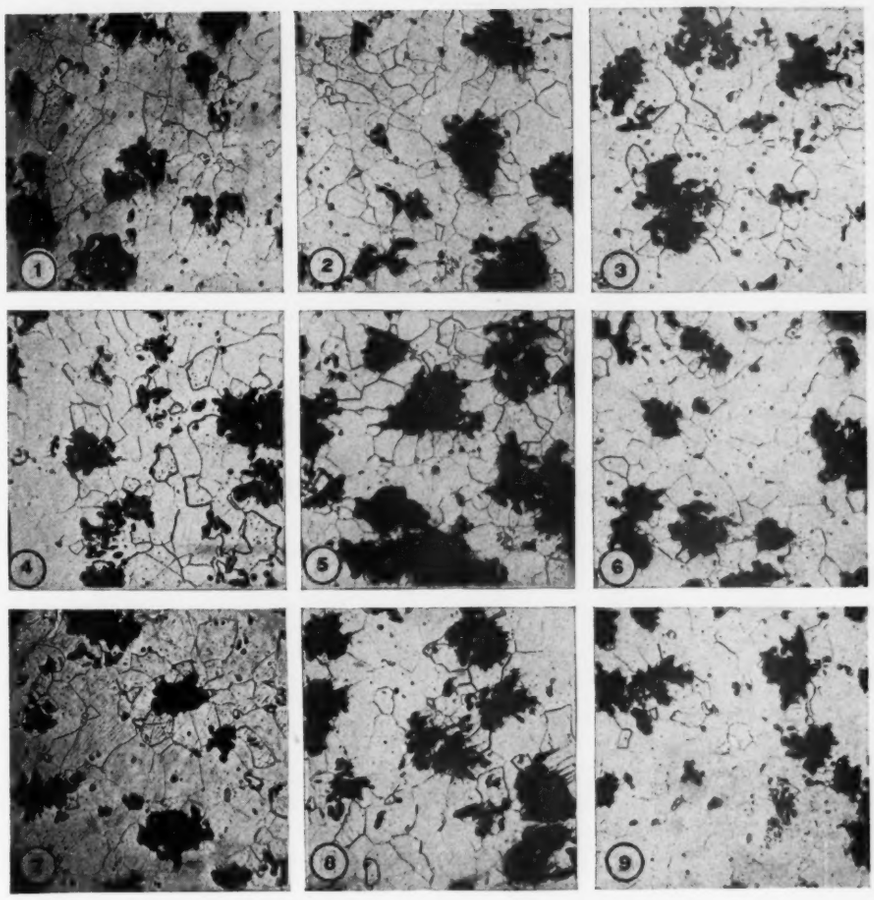


FIG. 4—MICROGRAPHS FROM DIFFERENT SECTIONS SHOW UNIFORMITY EXCEPT IN THE CENTER SECTION WHICH HAS SLIGHTLY LARGER AREAS OF TEMPER CARBON

difference in minimum tensile strength or, in fact, in any of the test values. The average tensile strength is exceptionally close.

The behavior of malleable iron under compression also is set forth by the author. It is stated that malleable cast iron in compression is practically indestructible so far as rupture of the surface is concerned, the action being continually to flatten out with no, or with slight indication of rupture on the outer surface.

The results including load and reduction in length on eight samples of different sizes are given in the accompanying table.

Material Does Not Fail

The elastic limit and yield point were not recorded in these tests, but the results are offered as confirming evidence bearing out the statement that the material does not actually fail although compressed to a point equivalent to the destruction of any actual structural detail.

Mr. Bean states that about ten years ago, working in co-operation with the Taylor Instrument Co., Rochester, N. Y., he determined the Ac_1 point in malleable iron to be at 1375 degrees Fahr. This, however, has been indicated since at a temperature slightly above 1400 degrees Fahr. and as the duplication of the curve provides checks, he believes this to be a more accurate determination.

Through the courtesy of the Leeds & Northrup Co., Philadelphia, he obtained curves or charts on unannealed and annealed samples of essentially the same chemical composition. Fig. 5 is a reproduction of the curve taken on the unannealed sample and Fig. 6, that taken on the annealed sample. Referring to Fig. 5, it may be noted that the Ac_1 point is located at 1405 degrees Fahr. and the Ar_1 point at 1375 degrees Fahr.

Consulting Fig. 6, it may be seen that on the annealed sample the Ac_1 point is indicated at 1420 degrees Fahr. and the Ar_1 at 1340 degrees Fahr., the difference in temperature of the two points being considerably greater than on the unannealed sample.

Effects of Carbon Conditions

It has been stated that the two samples were of essentially the same chemical composition, which is true, but the difference in the carbon condition in the two samples should be given consideration, all of the carbon in the unannealed sample being in the combined state and practically all of that in the annealed sample being in the graphitic or temper carbon form, and therefore inactive below the Ac_1 point.

Continuing, the author states that it should be expected in view of the foregoing, that the annealed sample on the heating side might act somewhat as a

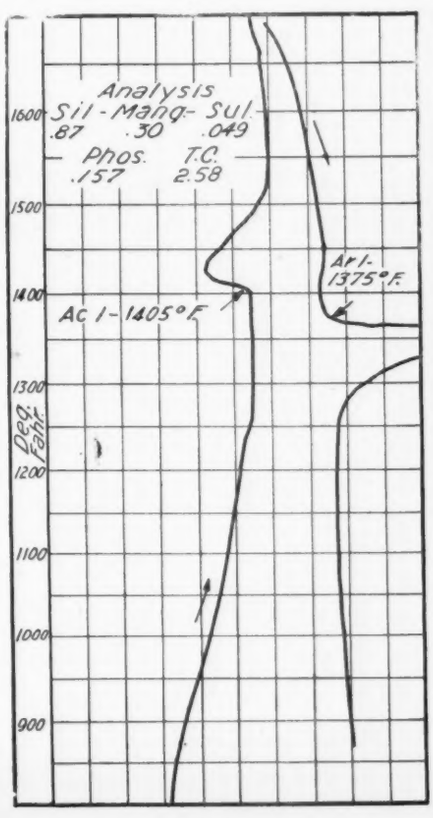


FIG. 5—UNANNEALED SAMPLE

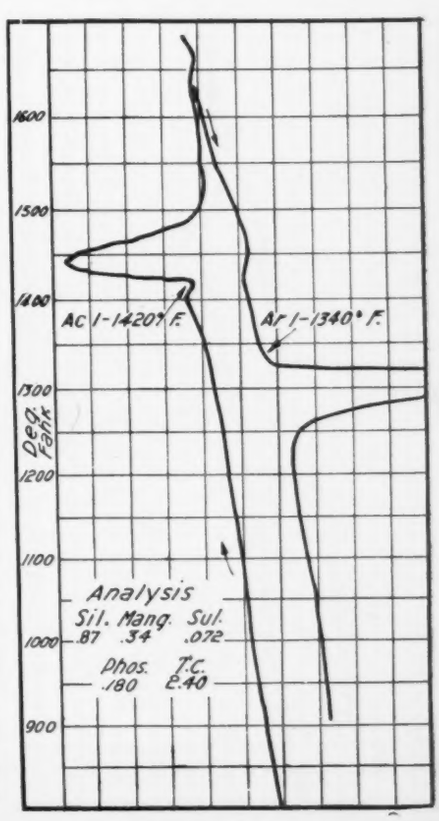


FIG. 6—ANNEALED SAMPLE

Compression Tests of Malleable Show That it Flattens With Slight Indication of Rupture

Size bar, inches Leng.	Diam.	Load, lbs.	Load, lbs. per sq. in.	Reduction in length, inches	Reduction in length, per cent	Surface Crack
1.141	1.122	*100,000	105,100	.260	22.7	None
1.129	1.134	*100,000	105,190	.256	22.6	"
.851	.837	*100,000	175,800	.393	46.1	"
.865	.862	*100,000	171,870	.377	43.5	"
.450	.418	37,300	234,600	.245	54.4	Slight
.440	.418	38,900	255 880	.233	52.9	"
.428	.425	43,910	305,140	.245	57.2	"
.425	.429	37,200	262,150	.225	52.9	"

*Maximum capacity of testing machine.

low carbon steel and in this connection, the following suggestions are made as a possible explanation of some of the less clearly indicated points on the curve:

"In the annealed sample, it would seem as though there is a split transformation, as it is called, that is, a transformation taking place at two separate points. It would appear that there is a transformation effect beginning at approximately 1350 and ending at 1400 degrees Fahr., which effect bears close similarity to the transformation effect of a low carbon steel. In other words, as though this is the Ac_1 point of a steel having 0.01 per cent carbon. Another interpretation which might be put on it, is that this point is really the Ac_2 point taking place before the Ac_1. This occurs in certain alloy steels and it is not impossible that it may be occurring here. On the cooling side of the annealed sample there is a transformation taking place through the range 1640 and 1420 degrees Fahr. It is difficult to say just what produces the effect which is present in the annealed sample at around 1650 degrees. Only repetition of the curve, using each time a different sample taken from the same bar, would clear up this action."

In the upper range of the curve above the Ac_1 point, the author expects more or less erratic results depending upon the resolution of the carbon, some of which under proper cooling conditions would be reprecipitated on the cooling side.

Welding Large Mill Engine Cylinders

BY L. M. MALCHER

TWO weeks after the signing of the armistice, one of the big steel rolling-mill engines of the Carnegie Steel Co., Farrell, Pa., which had been working steadily on war orders, broke down with the result that its service had to discontinue entirely. As a result of the breaking of a connecting rod at the point of reversal, the left-hand low-pressure steam cylinder of this engine—an Allis-Chalmers twin tandem-compound, reversing—was badly fractured besides several other parts being injured. The cylinder, shown in the accompanying illustrations, has an inside diameter of 70 inches. To obtain a new cylinder would require about 3½ months and while the engine was out of operation, 360 men would be thrown out of employment. Thus, in order to place the mill in operation as soon as possible and to prevent laying off employes, it seemed that a repair was the only solution. After oxyacetylene welding was decided upon as the method to be used, the Oxweld Acetylene Co., Chicago, was called upon to do the work. Three expert welders with the necessary equipment went at once to Farrell to undertake the jop.

With much success, the task progressed until it reached completion although at times a few difficulties arose to hinder the work. The total time required to finish the repair of the broken cylinder was 72 hours, which included the operations of chipping, preheating and welding. While dismantling the engine to have access to the low-pressure cylinder, a fracture was discovered in the 42-inch right-hand high-pressure cylinder. Welding this fracture required about 18 hours. Seven days from the time the welders were given the order for the work, the entire task was finished. In Table I is given data as to the size of the casting welded, the

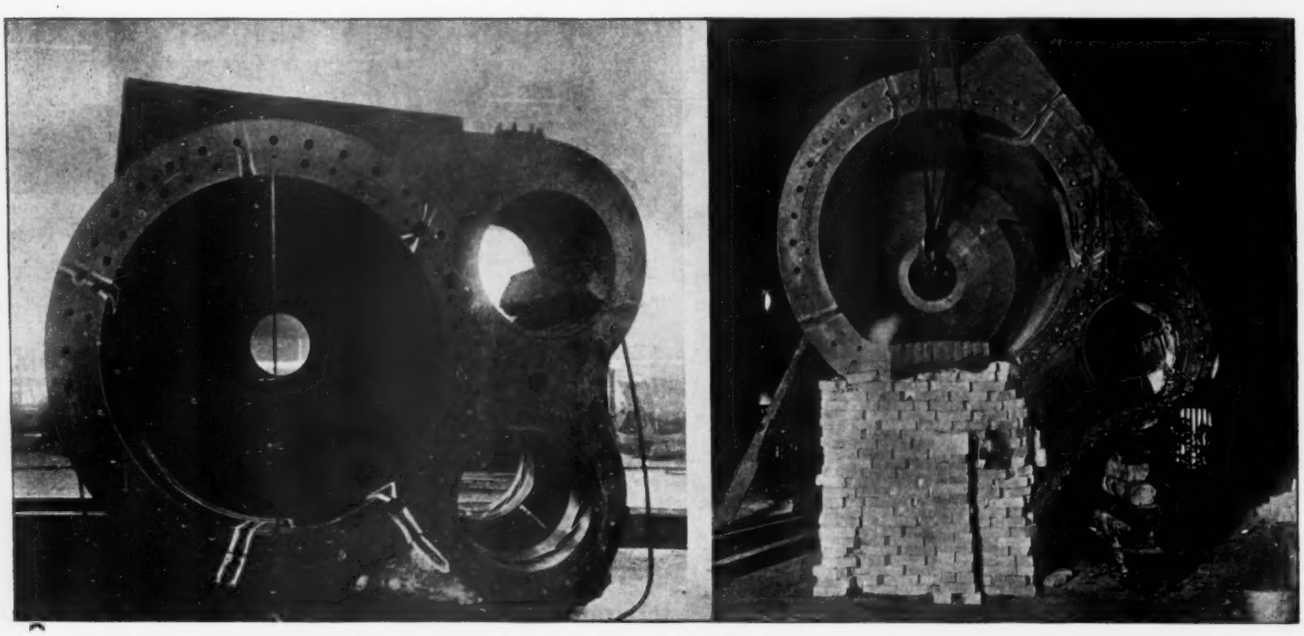


FIG. 1—WRECKED LOW-PRESSURE CYLINDER SHOWING THE CRACKS V-GROOVED BY CHIPPING PREPARATORY TO WELDING. FIG. 2—PREHEATING A CRACK IN THE LOW-PRESSURE CYLINDER WITH A CHARCOAL FIRE. THE CASTING WAS HANDLED BY CRANE

Table I

Low Pressure Steam Cylinder

Cylinder bore, inches	70
Stroke, inches	54
Weight of cylinder, tons	13
Thickness of iron castings, inches	2¾ to 3⅜
Number of cracks (See Fig. 1)	7
Total length of all cracks, inches	266
Preparing and preheating casting, hours	27
Welding casting, hours	45
Oxygen consumed, cubic feet	2850
Acetylene consumed, cubic feet	2845
Cast iron welding rods, pounds	390
Flux consumed, pounds	25
Period of welding shifts, minutes	10 and 30
Number of welders	3

amount of material required and the time required for the different operations in repairing the low-pressure cylinder. Similar information for the high pressure cylinder is given in Table II. The engine has a 5000-horsepower rating and is designed to give its maximum power while rolling and running at from 100 to about 110 revolutions per minute.

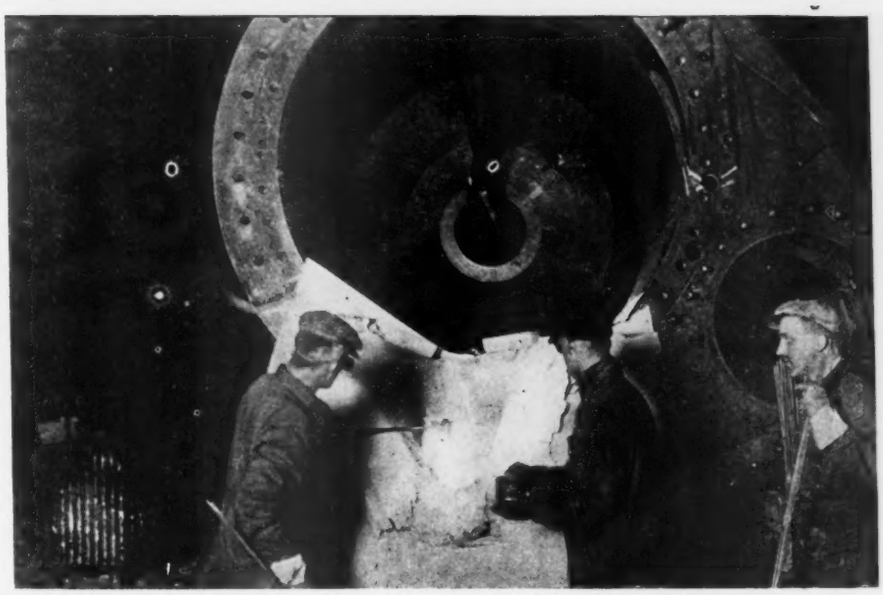


FIG. 4—WELDING THE LOW-PRESSURE CYLINDER —ASBESTOS PAPER WAS USED TO PROTECT THE WORKERS

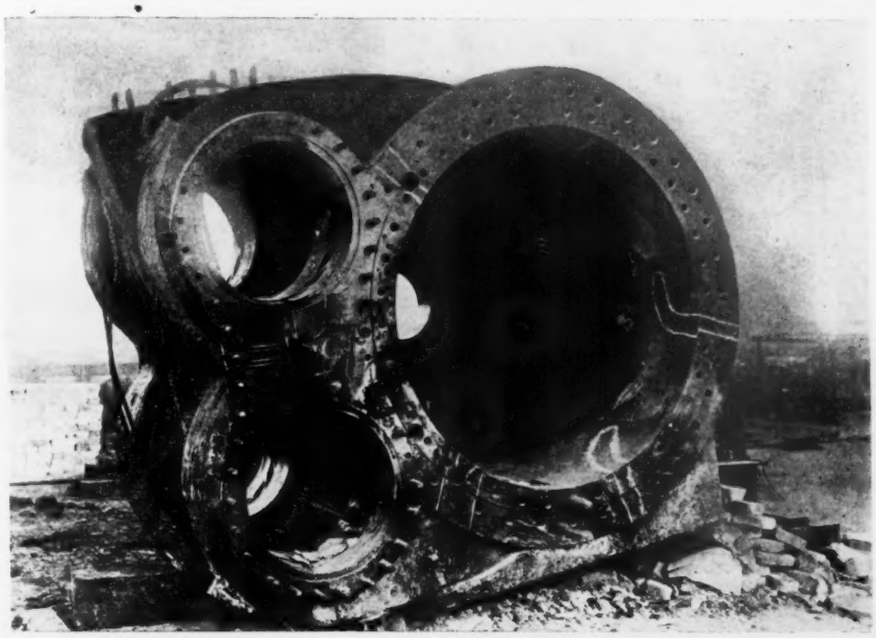


FIG. 3—LOW PRESSURE CYLINDER WITH WELDING COMPLETE—THE WELDS WERE FROM 1 TO 8 FEET LONG

While welding inside of the cylinder castings, the operators were forced to relieve each other every 10 minutes because of the intense heat reflected back on them, but while working on the outside the heat was not so intense and one man was able to work 30 minutes before requiring relief. After the cylinders were machined, it is said, it was almost impossible to determine where the cracks had been. Not only did the repair job make it possible to resume operation of the engine at an earlier date but the cost of repair was a small fraction of the replacement.

The Moak Machine & Tool Co., Port Huron, Mich., has opened its new gray-iron foundry. E. H. Moak is general manager.

Table II

High Pressure Steam Cylinder

Cylinder bore, inches	42
Stroke, inches	54
Weight of cylinder, tons	5
Thickness of iron casting, inches	3½ to 6
Total length of weld, inches	54
Preparing and preheating casting, hours	9½
Welding casting, hours	8½
Oxygen, consumed, cubic feet	650
Acetylene consumed, cubic feet	650
Cast iron welding rods, pounds	110
Flux, pounds	10
Period of welding shifts, minutes	10 and 30
Number of welders	3

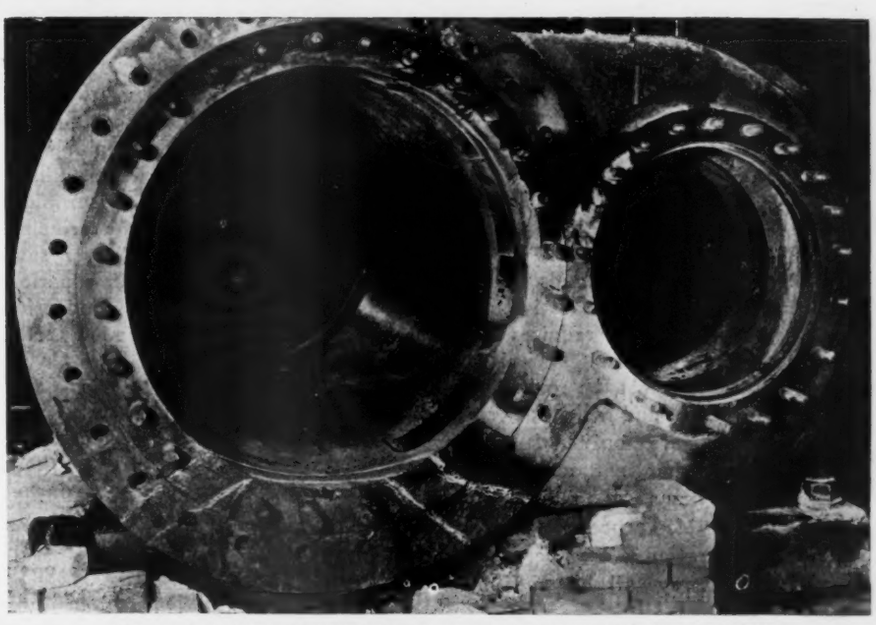


FIG. 5—A FLANGE WAS WELDED ON THE 5-TON HIGH-PRESSURE CYLINDER

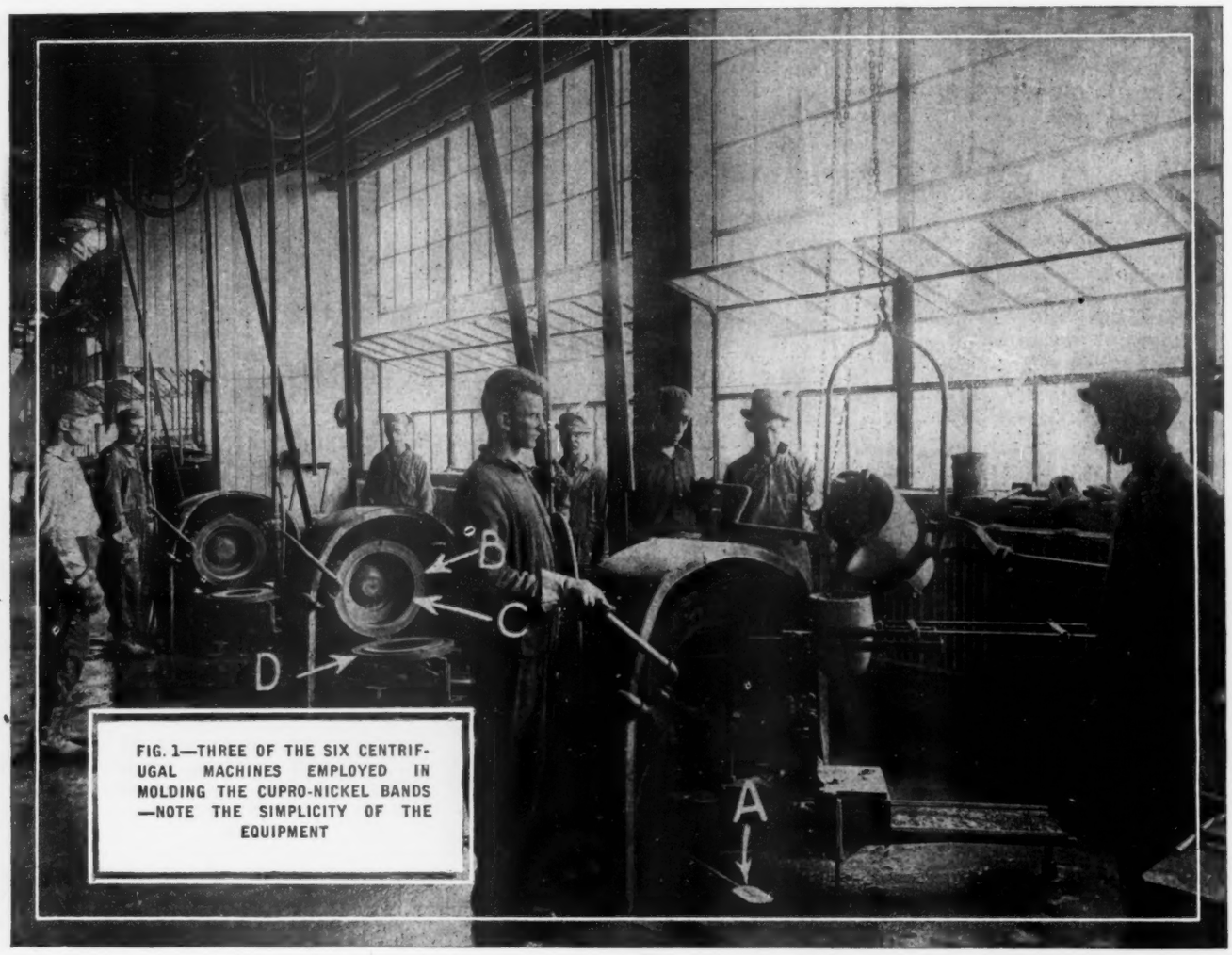


FIG. 1—THREE OF THE SIX CENTRIFUGAL MACHINES EMPLOYED IN MOLDING THE CUPRO-NICKEL BANDS —NOTE THE SIMPLICITY OF THE EQUIPMENT

Casting Copper in Spinning Molds

BY LOUIS J. JOSTEN

FOURTEEN and 16-inch cupro-nickel rotating projectile bands now are manufactured at the works of the George C. Clark Metal Products Co., Detroit, by the centrifugal casting machine process. This process is patented in the United States and foreign countries by George C. Clark, the president of the company, who experimented for more than two years before his centrifugal casting machine was pronounced practical.

Making cupro-nickel bands by the centrifugal casting process is novel in many respects, and requires keen judgment and practical knowledge. This knowledge must be gained by actual experience and scientific care. Details which are only of minor importance in other methods of casting become items of major consideration in this process, therefore individual operations are performed in a scientific way, all hit and miss methods being very carefully avoided.

The plant of the George C. Clark Metal Products Co. consists of a one-story building, 50 x 170 feet, which is partitioned off so that 2200 square feet is allotted to the furnace room and the remainder is used for the casting and machining room. The small amount of floor space required is one of the principal advantages of this method over sand casting. Another point of superiority is the lower cost of production over forged, rolled or extruded metal.

Castings Under Pressure

The soundness of a casting produced by this process is superior to one made in a sand mold, as there is no sand to wash away during pouring, causing sand holes, nor are the gases confined to cause blow holes. Centrifugal force acting upon the band during solidification has the same effect, greatly intensified, as a head placed upon a sand casting to produce a gravity force. In this process it is practically impossible for porosity to occur, if proper care is exercised in preparing and pouring. If any dirt or impurities are given off during melting and should get past the skimmer in pouring, it is known in advance just where to look for such impurities in the centrifugal cast band. The principal of the machine is like that of a cream separator. It separates the light from the heavier elements allowing the heavier portions to fly to the outer periphery. As all of the impurities in the cupro-nickel are lighter they assume the lesser radii. This actually happens and all foreign matter remains on the inner circumference of the band and easily may be removed in machining the band. All tests to the present have shown the complete absence of such impurities.

Another feature worthy of mention is the cleanliness of all departments

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of the plant. There is no foundry sand or dust, no sandy castings to knock off the edges of the machining tools, and no sandy turnings to remelt.

On the outside of the plant is an underground reservoir, which holds 20,000 gallons of oil for use in the furnace. A railroad siding is also provided for the loading of bands for shipment and for receiving materials.

about 2300 degrees Fahr., so as to allow a casting temperature of 2150 degrees. The correct pitch of the metal is tested from time to time by buttons before the metal is tapped. Care is exercised to see that the oil used is of a proper analysis, with a low sulphur content.

Handling of the metal is one of the most important features connected with this process. Positive methods are employed that permit the band to be cast at the correct temperature. This a most important point, for if the casting temperature is not correct, the physical tests will fail, rejecting the entire heat. Therefore, it becomes important that the casting room has a sufficient number of machines in operation to permit the removal of metal from the furnace in the shortest time possible, after it has been brought up to the proper pitch and temperature.

The three furnaces are melting about 20,000 pounds a day. The ladle receiving the metal from the furnace holds a sufficient quantity to pour three bands. It is carried to the casting room by an overhead trolley system. Extra precaution is taken to prevent the metal from oxidizing on its way to the casting room.

Fig. 1 shows one row of casting machines. There are two rows of three machines each in the installation. The principal parts of the machine are the die and die holder, the movable spout and the metal pouring attachment. The die and holder are driven by a shaft, to which is attached a foot lever brake, *A*, controlling the speed of rotation. The speed of the machine varies with the size of the die used, being about 1050 revolutions per minute for the 14-inch band.

The rotating holder, *B*, is plain carbon steel, while the die or liner, *C*, is a forging, specially heat-treated, and held in place by means of six set screws. A hinged cover plate of the same diameter as the holder, having an opening large enough to accommodate the pouring spout, is made to open and close on one side of the die and holder. This is shown at *D*, Fig. 1. This cover plate prevents the metal from running out of the die during the casting opera-

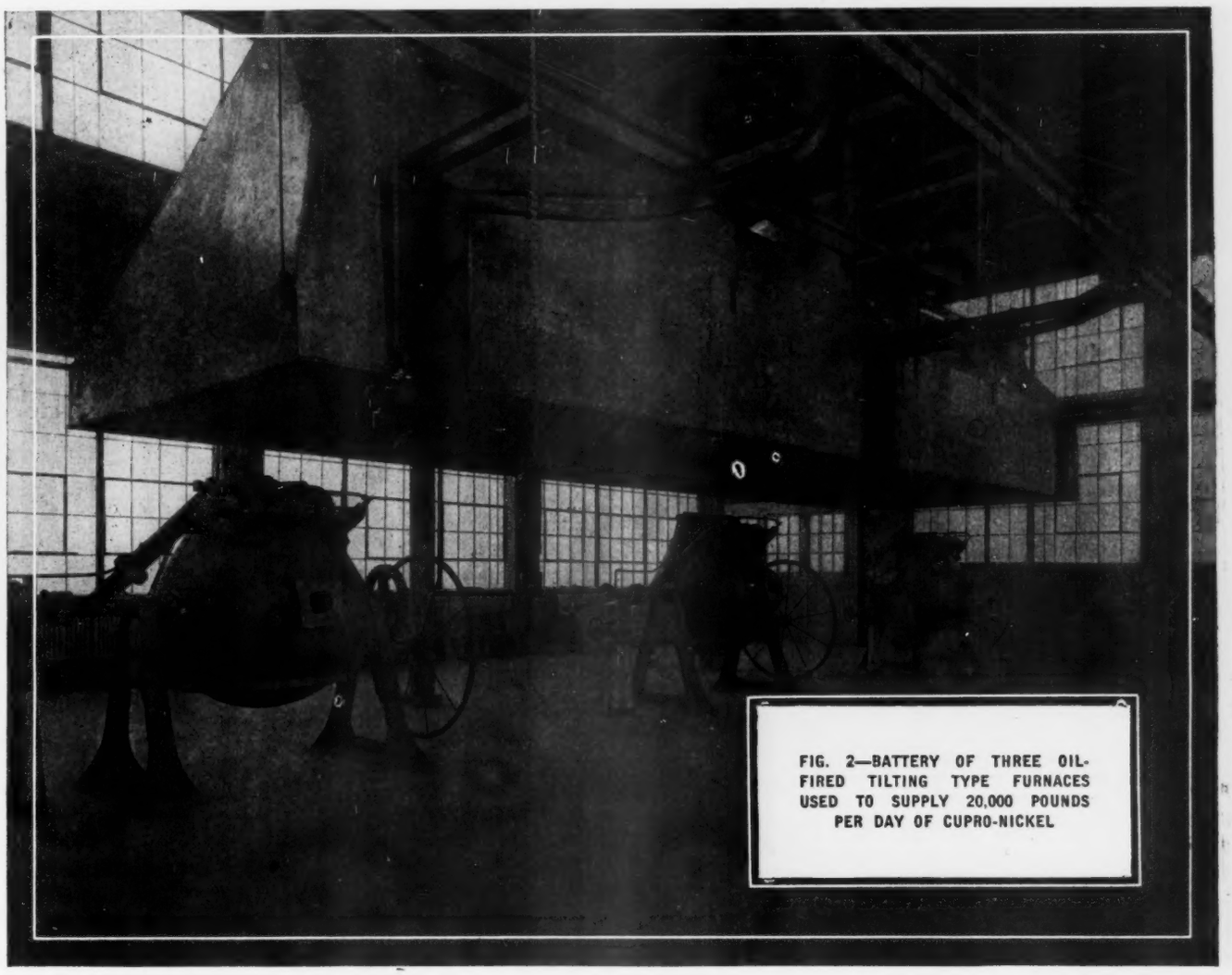


FIG. 2—BATTERY OF THREE OIL-FIRED TILTING TYPE FURNACES USED TO SUPPLY 20,000 POUNDS PER DAY OF CUPRO-NICKEL

Fig. 2, above, shows the furnace room equipped with three furnaces of 3000 pounds rated capacity each built by the Hawley Down Draft Furnace Co., Easton, Pa. Blast is furnished by three rotary pressure blowers, manufactured by the P. H. and F. M. Roots Co., Connersville, Ind. Ordinary methods of melting are employed. The mixture is composed of 97½ to 98 per cent copper and 2 to 2½ per cent nickel. Nothing but high grade ingot copper and the turnings from the bands is allowed as the specifications call for ingot copper of not less than 99.9 per cent purity. The nickel used is the best and purest grade obtainable. The tapping temperature is

tions. After the band is cast and has been cooled sufficiently, this cover plate is unscrewed and the band removed from the machine.

The life of the die or liner is limited. About 250 bands can be cast before it is burned out and must be replaced. All revolving parts are balanced with precision about the center of rotation. This is most important, for if they were not, the eccentricity would have a marked effect upon the product. The die and molten metal would form two masses in high rotative velocity, each assuming different radii of gyration, causing the mass of metal to change its relation with the periphery of the liner while still in a molten state. This would cause uncontrolled contractions in the castings.

The pouring spout and metal pouring attachment is made to move upon a V-slide. The position of this spout is most important as it must deliver metal to the periphery of the liner without excessive splashing. This spout is not permanently attached, but is raised and lowered for movement into or out of the die. The spout is supported near the pouring lip by a rod. Trunnion bearings made of strip steel and placed in line with the spout are constructed on each machine to accommodate the tilting of the pouring ladle.

Each machine is equipped with an air hose to direct a blast of air to remove all particles that may adhere to the die and cover plate after casting. A water pipe is connected with each machine and it may be adjusted by hand to supply water to the die during the casting for quenching purposes, or it may be swung back out of the way when the machine is not in operation. A drain pipe carries the water away from each machine. A sheet iron shield covers the die and holder as a safety feature to prevent excessive splashing of water or metal.

In preparing the machine for casting, the cover plate on the side of the die and holder is unscrewed and let down. The air hose is directed into the die to remove any foreign substance that may adhere to the die or inside of the cover plate. The die and the inside face of the cover plate are coated with plumbago. The cover plate then is screwed in place and powdered talc is sifted lightly on the inside of the die to keep the metal from adhering to the liner. The pouring spout is also coated with plumbago.

The machine is set in motion and the spout is moved forward to deliver the metal to the die. The molten metal is brought from the furnace room in a ladle of three times the capacity of the small crucible shown on the machine in Fig. 1. The amount of metal poured into the small crucible on the machine is just sufficient to pour the band with a small excess to be cleaned in machining. Pouring is accomplished by tilting the small crucible on the machine so that the metal flows through the spout into the die. While the machine is still in motion, the spout and crucible which move upon the V-slide are pulled back out of the way and the die is rotated until the metal solidifies.

When the band shows the desired color for annealing a stream of water is turned into the casting through the pipe mentioned. This pipe is adjust-

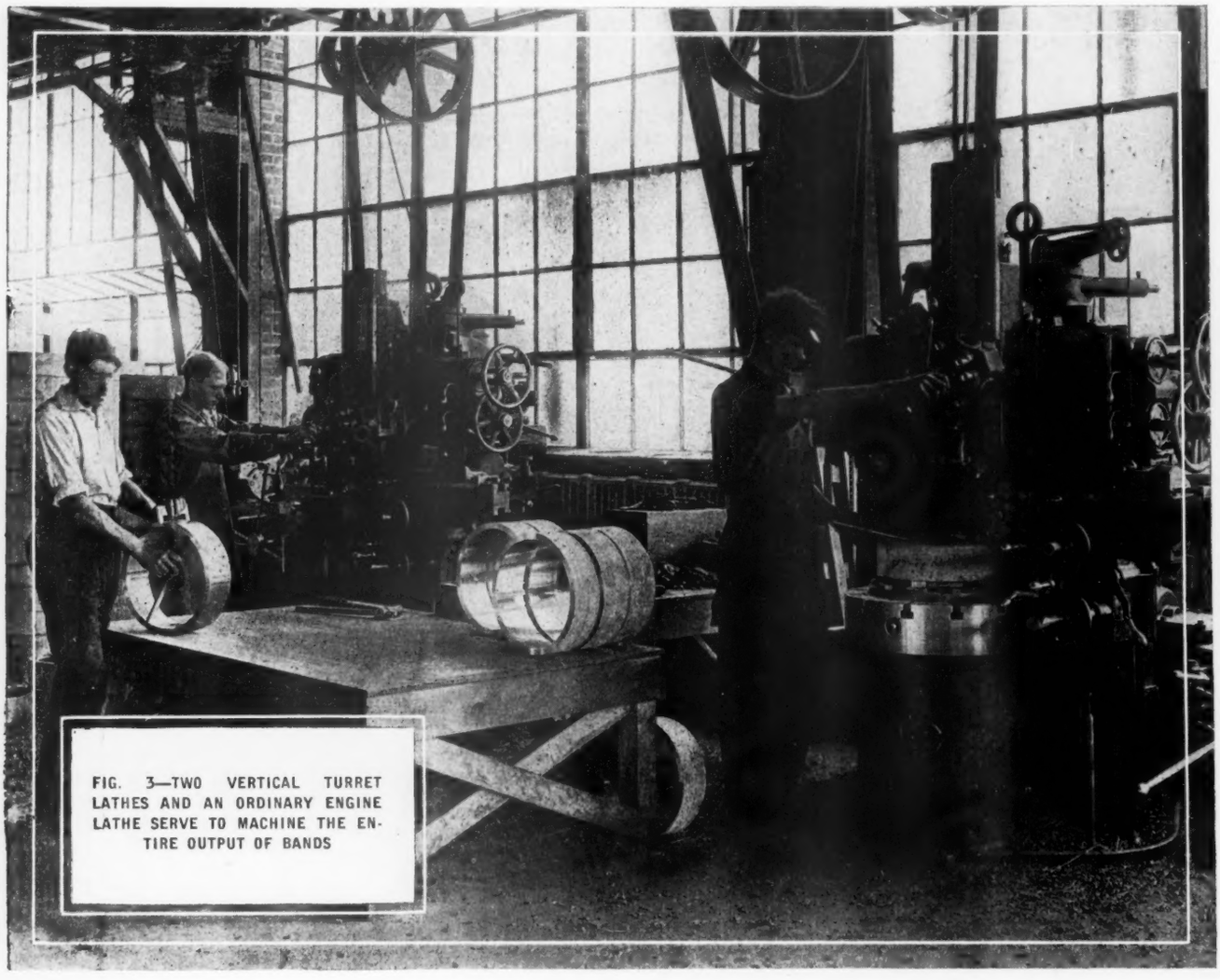


FIG. 3—TWO VERTICAL TURRET LATHES AND AN ORDINARY ENGINE LATHE SERVE TO MACHINE THE ENTIRE OUTPUT OF BANDS

able by hand so as to place it in the correct position. This feature saves considerable time and expense as the band is annealed by its own casting heat and quenched in the mold.

After the band has received its proper annealing, the water pipe is taken back out of the way so the cover plate may be unscrewed and let down allowing the band to be removed from the die. The band is then weighed to be sure that there is sufficient metal to allow for machining. The casting date is stamped upon each band, for example 7-2-3, denotes that it is a part of the third heat of July second. The date of casting and heat number are put on each band so if the heat fails to meet the chemical analysis or physical tests as required by the specifications, it may be identified and rejected. After the band is cast, it is necessary to clean the lip of the pouring spout, as a certain amount of metal clings to its sides and has to be removed by hand with a chisel.

Fig. 3 shows two vertical lathes in operation, one machining the inside of the bands; the other, the outside of the bands. These were made by the Bullard Machine Tool Co., Bridgeport, Conn. There are only three machines required to completely machine the bands, namely, the two turret lathes mentioned and an ordinary engine lathe. The first operation is performed on the engine lathe and removes the large fin which forms on the inside of the band during the casting as shown in the rough band in the right foreground of Fig 4. The second operation is set up on the first vertical lathe and machines the inside and the top face of the band. The fixture made to hold the band for this operation consists of three steel castings which are individually screwed down to the chuck of the machine so as to move universally when tightening or loosening one of the chuck screws. The band then is taken to the second vertical lathe, which is set up for machining the outside diameter and the reverse face of band. On this set-up, the band is held in place by an expansion toggle joint chuck made in three parts. The sharp edges of the band are rounded off. The band, now being completely machined, is moved on to the inspection bench where surface defects and gage dimensions are checked. The tolerances allowed in machining are very liberal, being 0.025 to 0.030-inch in most cases. A small auxiliary machine shop is operated in one corner of the building for machining the dies, holders and tests.

Two physical tests are required from each heat, one being taken from the beginning, and the other, at the end of the heat. The test pieces are machined to size designated in the specifications, namely, 1½ inches wide by ⅜-inch thick. The elongation is taken over a three-inch length. The physical requirements are as follows:

Tensile strength, 3000 pounds, minimum.

Elongation, 30 per cent, minimum.

Reduction of area, 35 per cent, minimum.

In the selection of test pieces, this process is at a disadvantage over other methods, as there is no way of obtaining test pieces without destroying a machined band, as each test selected must go through the same process of manufacture and heat treatment as the bands that it represents in the lot. The band from which a test piece is to be cut is first taken to an arbor press and flattened down to an opening of about five inches. Then a piece of sufficient length for a test piece is cut from the flattened side in a high speed cut off machine. The tests are then finished to the correct size and shape in a shaper. The ductility of rotating bands made by the Clark process is a point in favor of this method of manufacture, a large number of tests for elongation and reduction of area having averaged over 45 per cent above the specification requirements. A chemical analysis also is required from each heat that is poured.

Occasionally the band manufacturer makes special tests, not required by the government, for his own benefit or information. Several bands have been taken and flattened out upon the inside periphery of the band without showing any signs of fracture at the edges; others have been bent back on the outside periphery of the band with nearly the same results.

The inspection of the bands consists of an inspection for all surface defects and the gaging of all the machined surfaces with gages of a "go" and "no go" tolerances. When a sufficient number of bands have passed inspection, including the physical and chemical requirements, they are loaded and shipped to destination. Each band is marked with a government stamp to show them accepted.

How and Why in Brass Founding

By Charles Vickers

Specifications for Alloys

We would like to know what are the specifications for bronze of the Society of Automotive Engineers, including those for bearing metal, red brass, yellow brass, white brass and the various aluminum alloys in common use.

The following are the specifications for phosphor bronze bearings: Copper, 80 per cent; tin, 10 per cent; lead, 10 per cent; phosphorus, 0.05 to 0.25 per cent. For red brass: Copper, 84 to 86 per cent; tin, 5 per cent; zinc, 5 per cent; lead, 5 per cent. For yellow brass: Copper, 62 to 65 per cent; zinc, 31 to 36 per cent; lead, 2 to 4 per cent. For white brass: Zinc, 28 to 30 per cent; copper, 3 to 6 per cent; tin, 65 per cent. For babbitt metal: Tin, 84 per cent; antimony, 9 per cent; copper, 7 per cent. For No. 1 aluminum the copper range may be 5, 7 or 8 per cent with the remainder aluminum. For No. 2 aluminum: Zinc, 15 per cent; copper, 2 to 3 per cent; managanese, 0.4 per cent; aluminum, balance. For No. 3 aluminum: Aluminum, 65 per cent; zinc, 35 per cent.

Bronze Bearing Alloys

We would like to obtain a formula for making bronze bars to be used as bearings for stamping presses, also for motor bearings, in which the shaft runs on the bronze directly, no babbitt lining being used. We have tried the following formulas, but the customer considers them too soft (1) *Copper, 87 per cent; tin, 10 per cent; zinc, 3 per cent.* (2) *Copper, 85 pounds; tin, 12 pounds; zinc, 2.75 pounds; phosphor copper, 8½ ounces. The phosphor copper contained 15 per cent phosphorus.* (3) *Copper, 86 per*

cent; tin, 14 *per cent..* (4) *Copper,* 83 *per cent; tin,* 10 *per cent, zinc,* 3 *per cent.*

It is now generally acknowledged that lead is essential to a good bearing alloy; none of the above alloys contain lead, therefore it would appear that their failure is not due to softness but to lack of anti-friction properties. Alloys containing from 12 to 14 per cent tin, in one case with zinc and phosphorus also, cannot be said to be soft. If it is essential that a hard alloy be produced, the following mixture will be satisfactory: Copper, 73.50 per cent; tin, 12 per cent; lead, 7.50 per cent, and phosphor copper, 7 per cent. The phosphor copper should contain 15 per cent phosphorus, and should be added immediately after the copper has liquified, and followed by the tin and the lead. This alloy will require heavy feeders and large gates; it must be poured at a temperature a little above the solidification point. This can be judged by stirring a ½-inch bar of the same alloy in the molten metal, and when the liquid begins to stick to the bar, pour immediately and quickly. The following alloy while much softer under the brinell machine, we believe will be more satisfactory than the hard alloys for this purpose. Copper, 74.75 per cent; phosphor copper, 0.25 per cent; tin, 8 per cent; nickel, 2 per cent; lead, 15 per cent.

Facings for Brass Molds

Will you kindly advise us regarding a good facing for molds for brass castings weighing around 250 *or* 500 *pounds each. We have been using powdered charcoal and it does not seem to work to advantage.*

If the molds are cast while green, use plumbago dry as a facing. Get a good grade of plumbago from a supply house stating just what it is to be used for when ordering. Brush on the plumbago with a camels hair brush, using a flat brush, and after coating the mold well, polish the lead by lightly rubbing it with the fingers. Considerable dexterity is required in order not to have the lead stick to the fingers, tearing away patches of sand from the mold, but with care and by going over the surface softly, the mold can be polished like a stove. If the molds are dried, mix the plumbago with water, colored brown with molasses. Paint this molasses mixed plumbago over the mold surfaces with a camels hair brush. The plumbago should be like paint. Bake the molds afterwards to drive off all moisture, and the result will be a clean casting. The cores should also be treated with the plumbago wash.

White Bronze Analyses

We would like to obtain the analysis of Parson's white bronze.

Parson's white bronze, or Parson's white brass as it is also sometimes called, is a composition of zinc and tin mainly. It is used for bearings in a similar manner to ordinary babbitts. One analysis gives the following result: Tin, 65.12 per cent; zinc, 31.71 per cent; copper, 2.87 per cent; iron, 0.13 per cent; antimony, none; lead, 0.17 per cent. The iron and the lead are impurities contained in the base metals, which are tin, zinc and copper. The alloy depends for its quality upon the skill with which it is put together and the amount and quality of the deoxidizers that are used.

Recovering Dross From White Metal

We would like to know how to recover the metal from white metal dross. This dross is the skimmings of an alloy consisting of tin, lead and antimony.

If the dross has been reduced to the form of a dry powder by the use of fluxes on the bath of metal, it will not pay to attempt to recover the metal therefrom on a small scale. Under such circumstances it is advisable to dispose of the dross to a white metal smelter. If, however, the dross contains visible metal this can be separated and recovered by adding the dross to a kettle of hot metal, stirring it in then fluxing the bath by adding rosin. Tallow also is good and if the rosin fails to convert the dross to a dry powder, add some tallow also. Simply powder the rosin and scatter it upon the surface of the melted metal, then stir around. If the metal is not very hot, the rosin may throw off a strong smoke, without bursting into flame; but if the metal is hot the rosin will burn. When the dross is added to the metal in the kettle, the latter should be hot, otherwise, it will not melt the dross, but when the rosin is added, the metal need not be very hot.

In the case of metals containing zinc, the proper flux is salammoniac. It should be scattered on the surface like the rosin.

Manganese Bronze From Scrap Metal

We have on hand about five tons of yellow brass rod ends which we would like to turn into a fairly good grade of manganese bronze which we realize would have a low elastic limit, on account of the absence of iron. We would like to learn if the addition of 1 *per cent of manganese copper containing* 25 *per cent manganese, and around* 0.35 *per cent aluminum would give us the alloy we desire. We would add the manganese copper by placing it in the bottom of the crucible covered with charcoal, and place the scrap on top, cover that with charcoal and melt. Would the manganese copper melt at the temperature of the brass, if the latter was well heated?*

No difficulty would be experienced in adding the manganese in the manner stated, as the manganese copper would dissolve in the brass. The addition of the manganese and the aluminum would improve the strength of the metal resulting from the melting of the scrap, but it would be greatly inferior to real manganese bronze and just about as difficult to cast. If the rod ends are screw rod it might contain from 2 to 4 per cent of lead, which is entirely too high to permit its being used for manganese bronze. If it is naval rod mixture, it would be low in zinc for manganese bronze, but would contain no lead other than the small amount introduced as an impurity. Extruded rod might also contain lead. To decide this point it would be advisable to melt a pot of the scrap and cast it into ingot form.

Drillings should be taken from the first and last ingots poured. They should be thoroughly mixed and analyzed. This will give the composition of the scrap and there will be no question about whether it can be used in the manner outlined or not. If it can be so used the amount of zinc needed to bring up the strength of the bronze will be known. If the scrap contains much lead it could be used in making red metals, provided of course there is no aluminum present.

Machining Aluminum

We would like to obtain a mixture for aluminum castings that will machine without gumming up the milling tools. We want a metal that will machine clean in the lathe or milling machine. We would also like to get a mixture suitable for pistons.

The following alloy will machine satisfactorily: Aluminum, 82 per cent; zinc, 15 per cent; copper, 3 per cent. Melt a part of the aluminum until at a red heat, then add the copper as thin sheet. This will dissolve readily. When all is dissolved add the balance of the aluminum, and lastly the zinc. The copper can also be added in the form of a hardener composed of 50 per cent copper and 50 per cent aluminum. An alloy suitable for pistons is as follows: Aluminum, 90.50 per cent; copper, 9.50 per cent.

Where Art and Industry Are United

FIG. 1—BRONZE IMAGE OF AN EAGLE WITH 10½-FOOT WING SPREAD

THE Roman eagles that were proudly carried into foreign lands on the banners of Caesar's victorious legions, were an emblem of the power and glory of the Roman empire. Considering that they were used as an emblem of the mightiest empire the world had known up to that time, it was only fit and proper that they should be made of a material that was practically indestructible, but which would harmonize with the general scheme and accentuate the spirit of pride and pomp and glory with which the name of ancient Rome is enshrined in history. In those days, even as now, what metal could have been more appropriate than bronze? It was strong and tough, it was plentiful, it was easily worked, it lent itself readily to the most intricate shapes; but above all it defied corrosion from the elements and it could be polished to a dazzling brilliancy. We may rest assured that Caesar's standard bearers jealously guarded their beloved Eagles and saw to it there was neither spot nor stain or blemish on their glossy plumage. It is a pity that the art of printing was not discovered earlier. We might then familiarize ourselves with the early bronze foundry processes. What little we do know is based on a combination of elimination. It is fairly satisfactory but is not convincing and does not carry the authority of a first hand account. Ornamental bronze castings have always been made quite extensively in Europe, and it is only reasonable to infer that the methods in use at the present time are either the same or modifications of the system in vogue when the mail-clad legions clanked their way up and down the seven hills of Rome. The "Cire Perdue" or "Lost Wax" process is used quite extensively in Italy for making statuary and other large bronze castings. A complete description of this interesting method appeared in THE FOUNDRY, February, 1911. The French art foundries make most of their work in sand molds. This is due to the fact that a peculiar grade of sand especially adapted to this kind of work is found in France. When ornamental bronze work and statuary was first attempted in this country it was necessary to import both sand and workmen. Now, however, there are quite a number of American workmen who are quite as competent as the Europeans. It is necessary even yet to import the sand; for, up to date no one has discovered a grade of sand in America that can take the place of that which comes from France. French molding sand has the peculiar property that it can, and must be rammed quite hard and yet it will not cause the casting to blow. Another remarkable trait of this sand is that it may be used without artificial binder of any kind to make either green sand or dry sand molds. Among the foundries in this country engaged in the production of ornamental bronze castings is that of the John Harsch Bronze & Foundry Co., Cleveland. This plant is new, having been built less than a year ago. It is strictly modern in every respect and was erected according to the plans and under the direct supervision of John Harsch, a practical foundryman of many years' experience. The buildings are of brick and steel; large windows in all four walls as well as in the monitor roof afford ample lighting facilities as may be noted from Figs. 5 and 6.

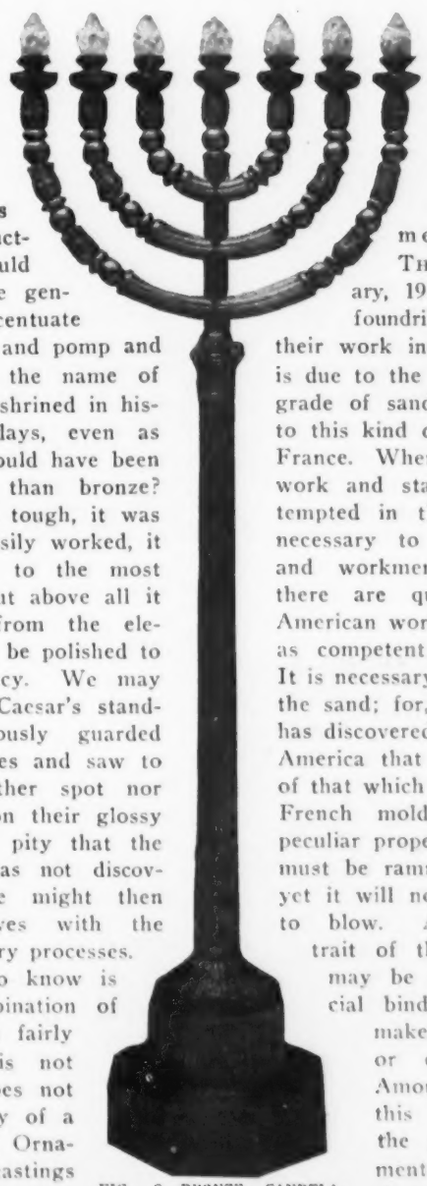


FIG. 2—BRONZE CANDELABRUM STANDING 7 FEET 6 INCHES HIGH

The main foundry building is 120 x 60 feet and is devoted altogether to molding, with the exception of one space where a furnace is set up for melting aluminum. The brass and bronze melting facilities are housed in a separate building adjacent to, and opening into the foundry on one side near the center. At the end of the foundry building proper but connected to it are the core room and the cleaning, assembling and shipping rooms. This part of the building is two stories in height the upper story serving as an office. The designing and pattern shop is situated in an isolated building across the yard facing the door of the shipping department.

Natural Ventilation Suffices

The buildings are ventilated by the natural system through the monitor roof. In the winter the temperature is maintained at about 70 degrees by a Bishop & Babcock vacuum installation. In planning and building this shop the employes' comfort and well being have been fully considered, for in addition to a well lighted and well ventilated building there is also a locker room in which the men can wash up and change their clothes. It is supplied with hot and cold water in basins and shower baths.

Besides making statuary and ornamental castings, the company does a general jobbing business in all kind of nonferrous metals.

The molding floor is divided longitudinally into three sections. The heavy work

FIG. 3—A CORNER NEAR THE COREROOM—SOME OF THE CORES USED ON THE SIDE FLOORS

is made in the center section; some of it in flasks and some in the floor. There is a pit in the center of the shop 40 x 20 feet in area and 6 feet deep for this purpose. This pit of course is kept filled up when not in use and the floor made level. Foundation plates were bedded in the bottom of the pit before it was filled the first time so that now a mold made any place in it can be held down with binders if necessary. This section of the shop is served by a 5-ton traveling crane.

The light work is made in the side bays shown in Figs. 4 and 5. Some of the molds are rammed by hand on the benches but most of the work is made on machines. For this purpose there are provided 12 air squeezers and two jarring machines made by the U. S. Molding Machine Co., Cleveland; and two Stearns hand-power squeezing machines. Air for operating these machines is supplied by a 9 x 10-inch Ingersoll-Rand air compressor which has a capacity of 150 feet a minute.

The melting installation consists of eight 30-inch, coke-fired pit furnaces, three open-flame tilting furnaces with a capacity of 700 pounds each and two crucible tilting furnaces, one of 150 pounds and the other of 275 pounds capacity. The coke furnaces are supplied with natural draft by a brick stack 5 feet square by 60 feet in height. The stack is built straight on the outside but has a pronounced taper on the inside, the opening at the top of the stack being much larger than the opening at the bottom. This feature, acting as a funnel, is said to increase the draft to a considerable extent.

The battery of furnaces shown in Fig. 8 was supplied by the American Foundry Equipment Co., Cleveland.

FIG. 5—SIDE BAY DEVOTED TO LIGHT WORK—NOTE THE EXCELLENT LIGHTING, HEATING AND VENTILATING ARRANGEMENTS

FIG. 4—SIDE BAY NEAREST THE MELTING SHOP SHOWING COREROOM IN NEAR BACKGROUND

They are set level with the the floor and as may be seen by referring to the illustration the covers swing on pivots and one is provided with a counterweight which takes the weight of the cover off the hook while the operator is swinging it off and on. For lifting the pots a 6-inch I-beam has been pivoted to the wall to act as a crane. A quadrant, also supplied by the American Foundry Equipment Co., hangs suspended from a trolley on the I-beam and facilitates the lifting of the crucibles out of the furnaces.

The open flame furnaces shown in Fig. 7 and the tilting crucible furnaces are fired with gas in the summer and oil in winter, not because the oil is better than gas, but because the gas supply is uncertain in the winter. The roof of the furnace building is quite high and the monitor style of the windows affords ample ventilation

A typical batch of cores is shown in Fig. 3. It will be noted that they are mostly light and fragile. They are made from an oil sand mixture and dried in two Coleman ovens, each 7 x 7 x 8 feet. One of the ovens is furnished with a car to accommodate large molds and cores; the other is of the drawer type. They are fired with coke from the rear. The fire places are below the level of the floor and a pit is provided in front of the firing doors in which a supply of coke is always kept.

The castings are cleaned in a sand-blast room fitted up by the American Foundry Equipment Co., Cleveland; from there they are taken to the chipping and assembling department, where the gates are cut off with band saws and the castings ground and finished. The ordinary commercial castings are then ready for shipment, but the statues and ornamental work, which are generally cast in segments, must be carefully fitted and assembled by skilled workmen. The joints are chased and finished and the chaplets cut off so cunningly that the finished joint defies detection.

The heroic bronze of Major General Upton, Fig. 9, was molded and cast in four sections: the head, the torso and the two legs. It was afterward fitted and soldered together as shown in the illustration. It was made in sand after the French fashion. A clay model was first prepared by the artist full size and complete in every detail. A plaster shell or impression was made off this. When the shell had set it was taken off, cleaned out, touched up here and there and oiled. The shell was then assembled, zinc plates being placed at those points where it was desired to part the pattern for convenience in molding. The mold was next filled with plaster and when the outside shell was removed an exact replica of the clay model was available as a pattern. Dividing the pattern by the thin zinc plates also served as an assurance that the different parts of the casting would come together again after they were cast.

In ordinary molding practice, the pattern either leaves its own core or there is a seperate core box provided. In statuary work neither of these methods is used. The mold is made first, and the pattern withdrawn then the mold is rammed full of sand to form the core. The core is lifted out of the mold and a thickness of sand corresponding to the desired thickness of metal in the casting, taken off it.

FIG. 6—CAST BRONZE RELIEF 3 x 6 FEET ERECTED AT OHIO MEMORIAL, LOOKOUT MOUNTAIN, CHATTANOOGA, TENN.

In the case of this particular casting a flask consisting of two copes provided with accurate guides was fitted up.

A match or follow board was laid on the floor and the pattern set in place. The various parting lines having been determined, drawbacks were rammed in all the pockets or undercut places and nicely smoothed off on the top side. Ramming the drawbacks was a slow and tedious process. The sand was packed into place with small wooden hammers having pliable handles which make them quite sensitive. Provision was also made while ramming the drawbacks for handling them and later securing them in their respective places in the mold. Large arbors were used in the heavy cores and wires, nails and rods in the smaller ones. Hooks were also provided for attaching them to the mold. Lycopodium was then dusted on and the first cope set in place and rammed. The cope and follow board were next clamped together and rolled over, the follow board taken off and the undercut parts of the pattern treated in the same manner as the first half. The second cope, which was destined eventually to be the drag, was then rammed up and lifted off, turned over and set on a pair of horses. The drawbacks were carefully lifted off the pattern and set in their respective places on the mold but not fastened in permanently. The mold was then given a spray of molasses water and placed into the oven.

The match was put on and the drag again clamped and rolled over. The flask was then lifted off, placed on horses and the drawbacks or loose pieces taken off the pattern and set in their places on the face of the mold. It was then sprayed with molasses water and placed in the oven with the other half.

When they were dry, both halves

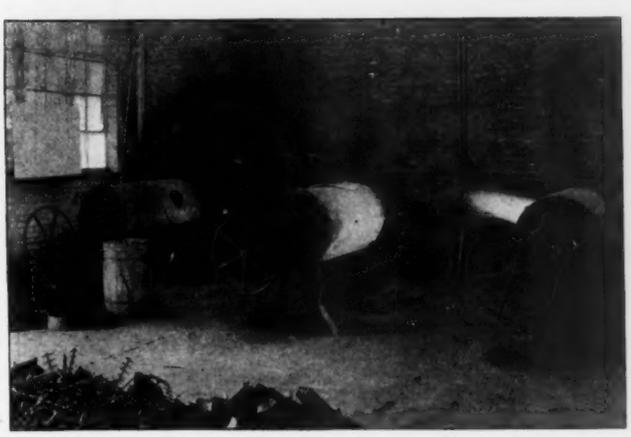


FIG. 8—BATTERY OF EIGHT COKE-FIRED PIT FURNACES—COUNTER FIRED WITH EITHER GAS OR OIL FIG. 7—BATTERY OF THREE OPEN-FLAME TILTING FURNACES—WEIGHTS ON THE COVERS RENDER THEM EASY TO MANIPULATE

FIG. 9—HEROIC FIGURE OF MAJOR GENERAL UPTON, 9 FEET HIGH, ERECTED AT BATAVIA, N. Y.

of the mold were taken out of the oven and assembled, an arbor fitted in and the mold cavity rammed full of sand. Steel pins were inserted at numerous points which were to serve as anchors, later on, in holding the core in its place. When the core was rammed the cope was lifted off, turned over and set on horses. The drawbacks of course stayed on the core. They were taken off one at a time and set in their places on the face of the mold. Wires were attached to the loops previously referred to in the arbors, and twisted around the cope rods.

The match was then placed on the drag for the last time and it was rolled over and lifted off. It was then turned face up and set on a pair of horses, the drawbacks taken off the pattern and secured to the face of the mold in the manner mentioned.

The next step was to provide for a thickness of metal. This was accomplished by taking a sharp knife and shaving approximately ¼-inch of sand off the entire surface of the core. The mold and core were then given a thin coat of molasses water and blacking and placed back in the oven. When the core was perfectly dry the mold was taken out, assembled and cast. The metal mixture consisted of copper, 88 per cent; tin, 8 per cent, and lead, 4 per cent.

Coke For Melting

By H. E. Diller

Question:—We have a 34-inch cupola equipped with one row of tuyeres. The distance from the sand bed to the bottom of the tuyeres is 15 inches. Our blower has a 12-inch discharge pipe. With this information can you tell us how much coke should be placed on the bed and what amount of coke and iron should be used on a charge?

Answer:—The best way to determine the proper amount of coke to use in a cupola is by actual experience. The primary object should be to get clean, hot iron and saving coke should be only secondary. We therefore recommend that at first the coke bed be made to extend 30 inches above the tuyeres and that 170 pounds of coke be used between 1500-pound charges of metal. A little saving can be made by adding 200 pounds of metal to the first charge that is placed.

After you become familiar with the working of the cupola under the fore-

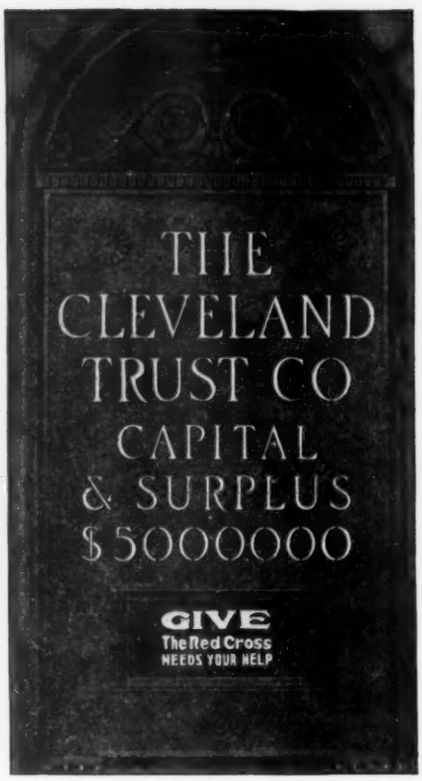


FIG. 11—BRONZE TABLET 10 FEET 8 INCHES BY 5 FEET 2 INCHES CAST WITH PERFORATED LETTERS

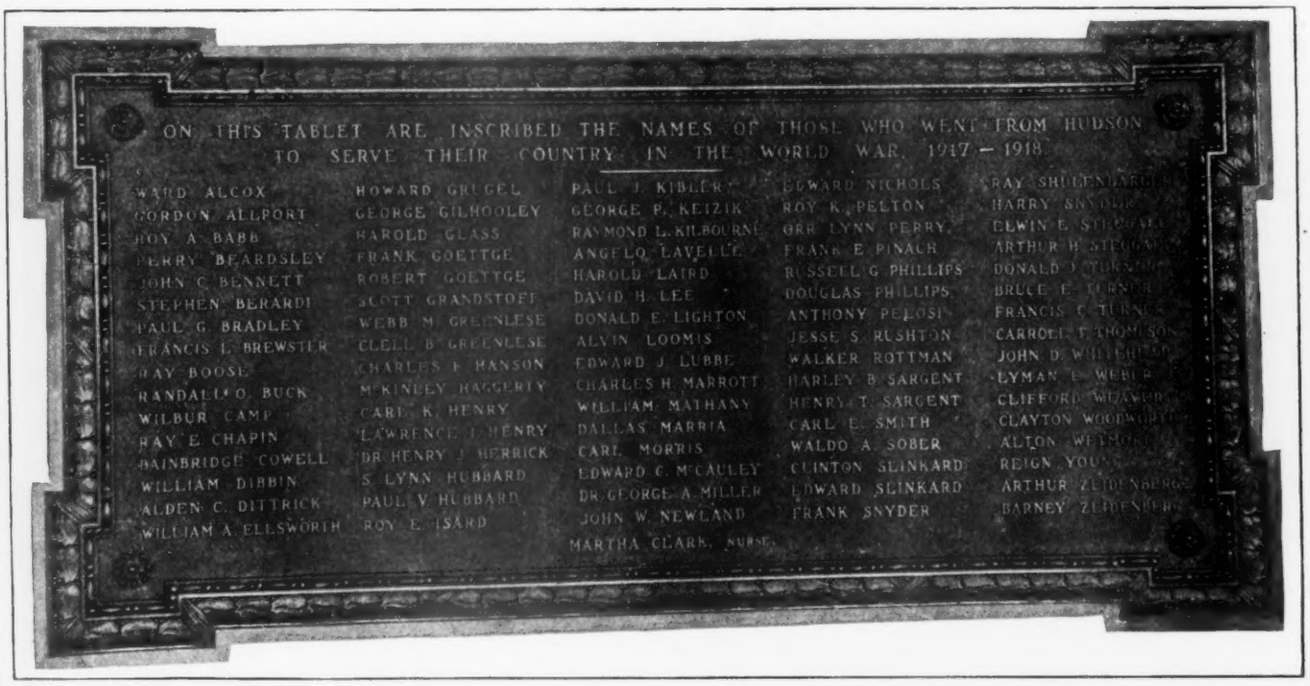


FIG. 10—HONOR ROLL, 5 FEET BY 2 FEET 6 INCHES, ERECTED AT HUDSON, O.

going conditions you can decrease the amount of coke on the bed in small steps until the first iron out of the cupola comes dull. Then add to the bed enough coke to insure hot iron. After you have found the minimum amount of coke which can be used on the bed with success, you should drop 10 pounds of coke off of each charge and if this proves satisfactory drop off some more until you reach the point where a further decrease will give dull iron. In this way you can tell by experience what is the least amount of coke you can get along with.

Keeping a Perpetual Stock Inventory

BY A. STANLEY KEAST

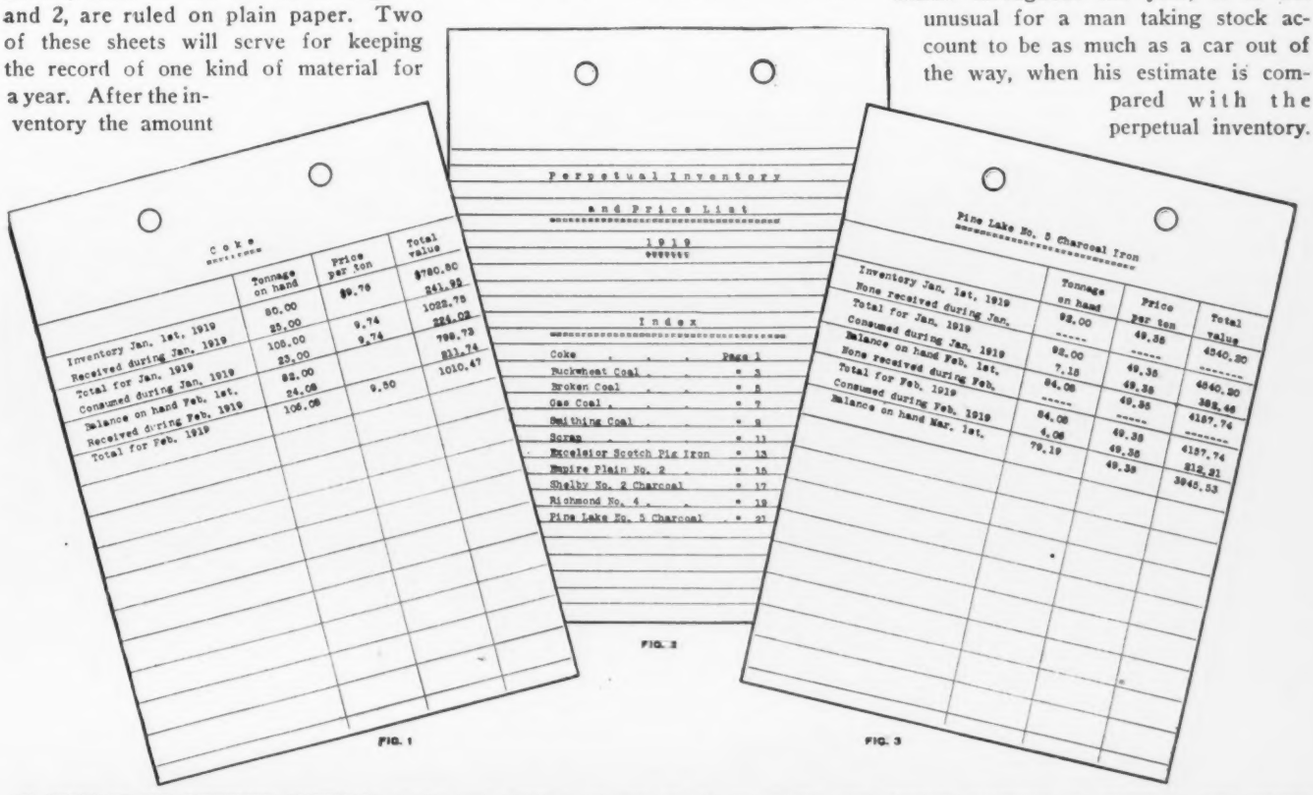
THE modern foundry organization finds it essential that a record be kept of the amount and price of the stock of raw materials, such as pig iron, scrap, coke and coal, on hand. The man who calculates the cupola mixtures needs this information in order to determine what kind of metal to use; the purchasing agent must keep informed regarding the amounts of the different kinds of material which are on hand, in order to determine when to place his orders, and the cost clerk must know the price of the stock being used when making his cost estimates. To furnish this information a simple accurate record, preferably a perpetual inventory should be kept.

Among my duties as consumption and production clerk in a large iron and steel foundry, it developed upon me to devise an inexpensive method for keeping such a record. A method was evolved which does not require the expense of printed forms. An index such as is shown in Fig. 2 is made out on the typewriter. Then a number of sheets, such as are shown in Figs. 1 and 2, are ruled on plain paper. Two of these sheets will serve for keeping the record of one kind of material for a year. After the inventory the amount of material on hand is recorded on the sheets and each month the amount used is added and the amount received subtracted in one column, while in two other columns the price per ton and the total value of material on hand are tabulated. The method may be clearly seen by studying Fig. 1 which shows a sheet of the coke record and Fig. 3 which illustrates the way the record is kept for pig iron. While this system is based on monthly balances, it can just as easily be adapted to weekly or even daily inventories if the information is wanted this close.

Furnishes Stock Check

This plan is now in successful operation at our foundry. Before it was adopted we frequently ran low in pig iron of certain grades, because we had no definite way to tell when to replenish our stock, and occasionally there was not as much iron on hand as we thought. Under the present system the purchasing agent has before him a record which tells how much metal of the various grades was used the month previous and how much is on hand. Another advantage of keeping such a record lies in the fact that one is able to arrive at the exact cost per ton of the materials on hand, through the law of averages. Raw materials, particularly iron and steel, are changing in value frequently and it becomes essential for the cost clerk to know the average value of the stock on hand in order to figure production costs of iron in the ladle.

As an added advantage, a perpetual inventory of so simple a character as the one here presented, proves a very efficient check on the work of those intrusted with taking the annual inventory. Pig iron stocks are difficult to estimate even when the iron is piled pig upon pig. When, however, it lies scattered about the premises without regard for order, it is next to impossible to estimate with any degree of accuracy just what tonnage is on hand. In such cases the value of a perpetual inventory can hardly be overestimated. Coal and coke are equally as difficult to estimate in bulk, and where large stocks are maintained throughout the year, it is not unusual for a man taking stock account to be as much as a car out of the way, when his estimate is compared with the perpetual inventory.



Coke

	Tonnage on hand	Price per ton	Total value
Inventory Jan. 1st, 1919	80.00	$9.76	$780.80
Received during Jan. 1919	25.00		243.92
Total for Jan. 1919	105.00		1022.72
Consumed during Jan. 1919	23.00	9.74	224.02
Balance on hand Feb. 1st.	82.00	9.74	798.73
Received during Feb. 1919	24.06		233.74
Total for Feb. 1919	106.06	9.80	1010.47

FIG. 1

Perpetual Inventory

and Price List

1919

Index

Coke	Page 1
Buckwheat Coal	" 5
Broken Coal	" 6
Gas Coal	" 7
Smithing Coal	" 9
Scrap	" 11
Excelsior Scotch Pig Iron	" 13
Empire Plain No. 2	" 15
Shelby No. 2 Charcoal	" 17
Richmond No. 4	" 19
Pine Lake No. 3 Charcoal	" 21

FIG. 2

Pine Lake No. 3 Charcoal Iron

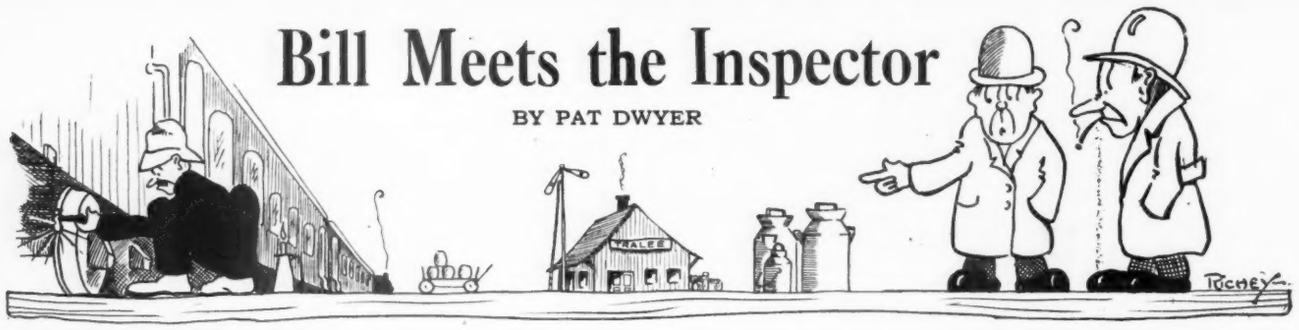
	Tonnage on hand	Price per ton	Total value
Inventory Jan. 1st, 1919	98.00	49.36	
None received during Jan.	-----	-----	4840.20
Total for Jan. 1919	98.00	49.36	-------
Consumed during Jan. 1919	7.15	49.36	4840.20
Balance on hand Feb. 1st.	84.06	49.36	353.46
None received during Feb.	-----	49.36	-------
Total for Feb. 1919	84.06	49.36	4187.74
Consumed during Feb. 1919	4.06	-----	-------
Balance on hand Mar. 1st.	79.19	49.36	4187.74
		49.36	219.21
			3945.53

FIG. 3

AN INDEX OF THE DIFFERENT MATERIALS SHOWS THE NUMBER OF THE SHEET ON WHICH ANY CERTAIN MATERIAL IS RECORDED—THE SHEETS GIVE THE AMOUNT AND PRICE OF THE STOCK ON HAND

Bill Meets the Inspector

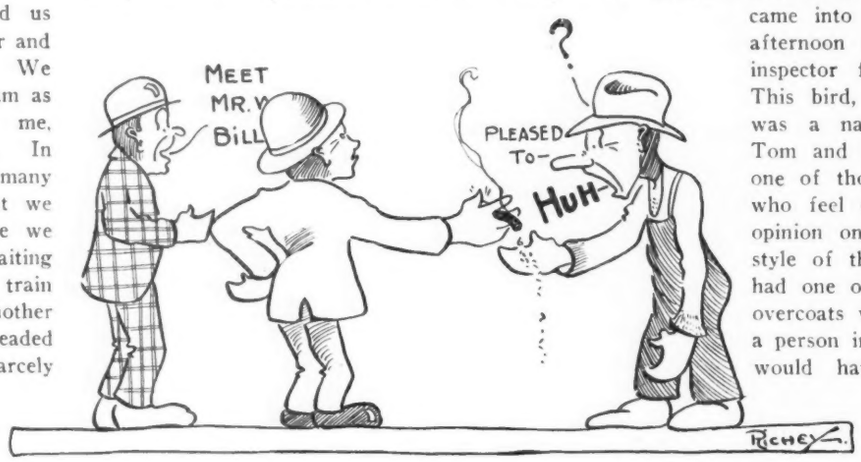
BY PAT DWYER



RECENTLY a friend from the old home town where Bill and I had served our apprenticeship sent me a message to the effect that he would pass through here on his way to the coast on a certain date. I immediately got in touch with Bill and we were down at the depot when the train arrived. Bill proposed that we board the train and ride as far as Tralee with our friend, as that would give us about three hours in which to let the years fall away and be once more as we were before Industry had caught us and bound us to the Wheel of Labor and all that kind of thing. We carried out the program as outlined and believe me, we had some visit. In fact there were so many items of interest that we reached Tralee before we realized it. While waiting at the station for a train to take us back, another tram pulled in headed West. It had scarcely stopped when a man walked the full length tapping each of the car wheels with a hammer. "There's a bird," I said, "looking for trouble. I wonder if he feels pleased or otherwise when he hits a wheel that does not ring like a Christmas chime.

"It's my opinion," said Bill, "that he is like the average human being not averse to a little notoriety. If he finds a cracked wheel he can have the car cut out and sidetracked. He hits the wheel with his little hammer and if the wheel does not respond cheerfully and resonantly, that settles it. It does not follow because a man can judge whether that wheel is sound or not by tapping it with a hammer that he is a car wheel expert, competent to advise manufacturers on how to make wheels. The same applies in a great many cases to inspectors on other lines of work. There are inspectors who are quite well qualified to do their work, but my pet aversions are the lads who strut about dressed in a little authority.

"It is pitiful in one way to see how seriously some take themselves. During the war good men were hard to find and I have seen representatives of every class appointed as shell inspectors. Just to mention a few of my personal acquaintances, there was a letter carrier, a plumber, a farmer, a gateman, a foundry clerk and a molder. Some of these men had never seen steel billets in their lives and did not know whether they grew under the ground in clusters like potatoes or whether they were the fruit of the iron tree which grows in the island of Juan Fernandez where Robinson Crusoe lived with the goats one time.



THE INSPECTOR WAS A MAN OF FEW WORDS

"I'll tell you of an experience I had one time which illustrates the broad assurance of an all-wise inspector. The jobbing shop in which I was working at the time secured an order for a lot of castings from a large plant in the vicinity. These were ordinary gray iron castings having no machine finish. Similar orders had been filled many times before and for that matter, many times since. On this occasion, whether for a joke or as it was rumored at the time, because of a mutual dislike between one of the high officials in the big plant, our customer, and the owner of our foundry, instructions were forwarded to ship no castings until after they were inspected.

"The information did not worry me because naturally I supposed that a man who knew something of castings would be sent to inspect them. We piled them up for a few days and then boss told me that Mr. Brighteyes would be around that afternoon to give them the once over. There had been one of those periodical upheavals in management at the big plant and when the dust clouds had settled the shop superintendent who was a very competent man found himself appointed assistant master mechanic. His successor was selected from the force in the drafting room. My boss came into the foundry in the afternoon accompanied by the inspector from the big plant. This bird, I felt instinctively, was a natural born Peeping Tom and Paul Pry. He was one of those veneered fellows who feel qualified to pass an opinion on anything, even the style of their wife's hat. He had one of these funny-Benny overcoats which no one except a person impervious to ridicule would have the courage to wear in public and he carried his nose cocked at an angle which plainly expressed his opinion of our modest establishment.

"'Bill,' said the boss, 'Meet Mr. Wisdom. He has come to inspect the castings for the A. B. & C. Co., and I wish you would render him any assistance necessary." Our hero very kindly allowed his gaze to rest on me for a moment to acknowledge the introduction but did not offer to shake hands nor did he say, 'Pleased to meecha.'

"I don't mind admitting that I like a reticent man, a man of few words but there is such a thing as carrying a virtue to extreme. It occurred to me that this reticence might be caused by quite proper motives and then again it might be caused by something else.

"I greeted him pleasantly and intimated that if he would be kind enough to follow me I would show him the castings. The small castings, that is, those that could be

cleaned in a tumbling barrel were in one place and the large castings, which had to be handled with the crane, were in another. 'In the future,' said he, 'I wish you would arrange to have them all in one place, you might also have them spread out in order to be easily accessible. However, before examining the castings, I should like to look over your molding and melting facilities and also the stock of material in yard. I wish to satisfy myself that you are putting nothing but the very best material in our order.' As I said before, I have no objection to an inspector who knows has business. I don't even feel sore if he condemns a casting, because I am satisfied he would not do so unless he had some good reason, but it is not absolutely necessary that a man should know the details of manufacture to determine whether an article is suitable for the intended purpose. I can sit at a table without the slightest knowledge of how food is prepared and pass judgment upon it. I can go into a tailor shop, and without pretending to have any familiarity with cloth or the rules and processes by which garments are fashioned, pick out a suit that will meet my requirements. I can buy a ticket in New York and a week later be in Liverpool without having the slightest acquaintance with either the science of navigation or engine room practice. The cook, the tailor, the navigator and the engineer know the details of their business and I do not. They allow me the right to accept or reject their products or services, but they would object, and I maintain that they might very properly object, to my interfering with their methods.

"This gallant young future captain of industry who had bravely fought his way up from blue print boy to draftsman, looked over the coke pile, then picked up a lump and examined it with a knowing air. 'Is this bee-hive or by-product coke?' said he. I said it was by-product. 'No good,' said he in a tone of finality. 'Nothing but beehive coke is fit to melt iron.' I said I was sorry to hear that and I was sure the owner of the foundry would grieve over it. He had bought the coke under the representation that it was standard 72-hour Connellsville foundry coke and highly recommended as a medium for melting iron. We had been using it for quite a while and had made hundreds of tons of satisfactory castings with it. 'Twas certainly discouraging to hear that the stuff was no good.

HE FOUND THE BEEHIVE COKE ALL HONEY-COMBED

"Having settled the fuel problem we moved over to where the pig iron was piled. He wanted to know if we had any No. 1 iron. When I showed it to him he expressed a desire to have a pig broken so that he might examine the fracture. I quoted the analysis we had received from the furnace and even offered to get a copy from the office, but he pooh-poohed the idea.

"'You cannot rely on the blast furnace analysis,' said he. 'Where I come from the grading is all done by fracture.'

"Now you know, and I know, that it is possible for an experienced man to approximate the silicon content of pig iron pretty closely by the fracture, but the experience must be received in the iron yard and not in a drafting room. One of my athletes kindly came forward with a sledge hammer and broke a pig in two. The inspector (save the mark) picked up one of the pieces and scrutinized it closely, turning it from side to side so that the light might strike it from different angles. He finally threw it down and gazed at me severely. 'That is not No. 1 iron,' said he. I admited that perhaps it did not equal the No. 1 iron used in the vicinity he came from, but it was commonly accepted as No. 1 iron on this side of the Atlantic. I knew we had paid a No. 1 price for it. Further more, it acted exactly like No. 1 iron in the furnace and showed every characteristic of No. 1 iron in the castings. Our scrap pile shocked him. 'Why,' said he, 'It is quite rusty. Your scrap should be covered to protect it from the elements. Iron oxide, which perhaps you may have heard is the proper name for rust, is the most dangerous material you could possibly put in your cupola.'

"I told him I would make a note of the fact and that hereafter we would tumble all the scrap or have it sandblasted before using it. He criticized everything around the place as freely as if he knew what he was talking about but reached the limit when he found fault with the sand we were using.

"'I shall certainly refuse to accept any of your castings,' said he, 'until you make them in the right kind of sand. Our order distinctly specifies green sand castings and every particle of sand in your foundry is black.'"

Our train came along just then and after we were comfortably settled Bill resumed. "He looked all over the castings we had made and then left. When I saw the boss I told him that if that bird came over any more he would have to detail some one else to show him around. I had a wife and children depending on me and I could not afford to take any chances on being tried for murder.

"Fortunately about that time my services were sought by another corporation or as they say in clerical circles, 'I was called to another field of endeavor.' The call was quite loud and distinct so I accepted. I have never seen or heard of our hero since and for that matter I never want to." He reached into his hip pocket and produced a pack of cards and we played all the way back to town. He won 65 cents from me but paid my taxi fare.

BILL FAILED TO MAKE HIS CAR FARE HOME

THE FOUNDRY

A semimonthly journal devoted to all branches of the foundry trade

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German Castings Production Drops

DURING the past few months rumors have been abroad which have much of the old familiar tang of early war propaganda. Vague and intangible as were many of the inspired praises of that "wonderful German efficiency" which circulated through the press and by word of mouth while the first advance was made through Belgium, these post-armistice rumors have had the same general tenor. We have been informed by them that while England, France and the United States are torn by industrial strife and hampered by shortage of labor and material, Germany is busy in shop, forge and foundry, preparing for unprecedented production. Further, we have been led to believe that even while the troops were in the field in 1918, production along commercial lines was steadily developed, and when the governmental change was effected every normal function of manufacturing was at once resumed. Simultaneous with these statements has come the steadily growing call for raw materials and food urgently needed. The inconsistency between the rumored manufacturing boom in Germany and the reported famine conditions is apparent.

It now becomes possible to draw definite conclusions with reference to industrial conditions throughout Germany, judged from the state of that country's castings industry. How lack of fuel and other factors of political and social chaos have affected the foundry business is apparent from the figures on production recently made available through the terms of the treaty of peace. The statement given out by the peace conference in Paris does not mention what classes of castings are included, but from the quantities shown it is evident that steel, iron, brass and other nonferrous castings, and possibly some ingots, are included. The figures by months in metric tons follow:

	1917	1918	1919
January	1,082,797	933,570	506,185
February	943,547	892,788	475,586
March	1,104,653	1,039,092	558,788
April	1,131,620	1,084,601	439,975
May	1,198,171	1,184,794	524,986
June	1,124,998	1,182,415	531,632
July	1,190,014	1,179,947	580,819
August	1,185,963	1,155,084	568,785
September	1,119,635	1,105,366	531,167
October	1,076,222	1,057,920	.....
November	1,007,731	565,706	.....
December	976,891	481,308	.....
Total for 9 months	10,081,407	9,757,657	4,717,923
Total for the year	13,142,241	11,862,621	.....

February is notably the low month in the three years given, as might be expected in view of the climate and the shortage of coal even during the occupation of coal mines in Belgium and part of France. The significant feature is the remarkable slump coincident with the armistice, when the tonnage dropped to about 54 per cent of that attained in the previous month. Including the four months of May, June, July and August, the past year shows only 47 per cent of the production attained during 1917 and 1918 when Germany was straining every sinew to hold back the allies. The complete figures for 1918 show a slight slackening, about 3 or 4 per cent under 1917, as the drop in November and December served to prevent last year from far excelling the previous. The figures for the first nine months' production over the three years show that 1919 has fallen behind the two previous years by more than 50 per cent.

Trade Outlook in the Foundry Industry

ANOTHER menace to the prosperity of the foundry industry, the greatest which it has faced through the period of the war and the temporary depression following is fading. The coal strike, threatening alike the source of supplies in metals and fuel and the many channels of demand through the forced closing of plants which use castings and depend upon coal for manufacturing purposes, has ended after five weeks. The menace of a complete cessation of foundry activities is removed, but the restricting effect doubtless will remain through many months.

After-Effects Remain

More than 60 per cent of the casting plants in the United States and Canada are dependent upon coke as a melting medium. These were threatened by an unprecedented condition in early December. The coke producing regions centering mainly in Pennsylvania and West Virginia, with scattered ovens in other sections of the country, at first remained little affected by the strike. In the majority of the coke making districts the supply of coal was assured by the steadfast refusal of miners in these regions to follow the miners of Indiana, Illinois, Ohio and other sections in the precipitate strike. However, this condition was only temporary. The central coal committee at Washington directed a curtailment of 25 per cent in supplies of coal for beehive ovens in all regions. The estimated restriction of output in the Connellsville district alone amounted to over 65,000 tons a week. This order did not affect by-product plants which furnish a portion of the foundry coke supply. The effect of this order was far reaching, and a supplementary decree was issued, providing that coal only should be loaded at beehive plants on Wednesday and Saturday of each week. A further reduction to 50 per cent of normal capacity was under contemplation at the time the strike was settled. Although the by-product output was not threatened and a restriction of coal supplies seemed to promise a reduction in demand for coke, the administration orders resulted in a wild scramble for coke on the part of brokers buying for both furnace and foundry users. This produced a coke market on Saturday, Dec. 6, which was unprecedented. As high at $15 per ton at the ovens was offered. The inevitable resulted. After a one-day wild market, the government wartime prices were restored by the fuel administrator. This move placed all available coke supplies as much under government control as was the bituminous coal industry.

Supplies of coke in many foundries have been severely taxed and in many sections a complete suspension of foundry operations has been imminent. It will take a certain period for normal shipment of coke to be resumed and the winter freight congestion probably will still further impede supplying the foundry demand for fuel. Foundrymen were threatened on yet another flank by the scarcity of coal for producing sea-coal used in facing sand mixes. The annual consumption of this material runs over 1000,000 tons per year, and the strike following so closely on unprecedented demand forced makers of sea-coal to dole out their product in 1-ton lots.

Pig iron producers, both in the North and South have been obliged to draw from stock piles in addition to shipping their daily production in order to supply the need for foundry grades. Pig iron production showed a gain in November, according to figures presented by *The Iron Trade Review* of Dec. 4. The total output in November was 2,381,327 gross tons, a gain of 516,903 tons over the previous month which showed 1,864,424 tons. This was an increase of 19,237 tons per day. Merchant iron production after more than holding its own under the steel strike conditions existing in October showed improvement in November. The total merchant output was given as 644,189 tons, an increase of 69670 tons over October. The gain in daily production of November over October was 2940 tons or 15.9 per cent. Nine stacks were blown in and only four blown out among the merchant iron producing furnaces, making a net gain of five in November. However, even with this gain considered, the total production of pig iron for the first 11 months of the year is 7,236,710 tons less than for last year. When this factor is considered coincident with the increasing demand for steelmaking grades which has been growing steadily, the possibility of lower prices for foundry pig iron seems remote. Pig iron prices continue to advance as may be noted from comparing the price table accompanying with the one published Dec. 1.

Prices of Raw Materials for Foundry Use

CORRECTED TO DEC. 8

Iron		Scrap	
No. 2 Foundry, Valley	$35.00 to 36.00	Heavy melting, steel, Valley	$22.75 to 23.00
No. 2 Southern, Birmingham	35.00 to 36.00	Heavy melting steel, Pittsburgh	24.00 to 24.50
No. 2 Foundry, Chicago	35.00	Heavy melting steel, Chicago	21.00 to 21.50
No. 2 Foundry, Philadelphia	37.10 to 39.10	Stove plate, Chicago	29.25 to 29.75
Basic, Valley	34.00	No. 1 cast, Chicago	34.00 to 34.50
Malleable, Chicago	35.50	No. 1 cast, Philadelphia	30.00 to 32.00
Malleable, Buffalo	35.50	No. 1 cast, Birmingham	26.00 to 27.00
		Car wheels, iron, Pittsburgh	31.00 to 32.00
Coke		Car wheels, iron, Chicago	29.50 to 30.00
Connellsville foundry coke	$7.00	Railroad malleable, Chicago	28.00 to 29.00
Wise county foundry coke	7.00	Agricultural malleable, Chicago	28.50 to 29.00

Activity Grows

One strong factor in the price advance is the continued growth in iron foundry lines. Where the labor supply permits and operations have not been crippled many plants, notably stove works and makers of enamel sanitary goods, plumbers' supplies, and cast iron pipe have installed night shifts and are expanding existing foundry facilities. Casting prices are advancing. This holds true also in nonferrous castings, as with few exceptions the prices for nonferrous metals are higher for November than October and exhibit an upward trend for December. Based on New York quotations, copper is quoted at 18.00c; lead 6.90cto 6.95c; tin, 54.50c to 55.00c; antimony, 9.50c; aluminum, No. 12 alloy, producers' price, 31.50c, and open market, 29.00c to 30.50c. Zinc is quoted at 8.50c, St. Louis.

Comings and Goings of Foundrymen

WILLIAM M. CORSE has resigned his position as technical superintendent of the Ohio Brass Co., Mansfield, O., to become general manager of the Monel Metal Products Corp., Bayonne, N. J. The latter company which specializes in monel metal and aluminum bronze castings was formerly the Bayonne Casting Co. Mr. Corse's experience particularly fits him for his new duties. Previous to his connection with the Ohio Brass Co. he was associated with the Titanium Bronze Co., Niagara Falls, N. Y., and the Detroit Lubricator Co., Detroit. In 1908, he was elected secretary-treasurer of the American Institute of Metals, now the Institute of Metals division of the American Institute of Mining Engineers, and became president of that society in 1917. He still is actively identified with technical society work on nonferrous metals.

Frank B. Gilbreth addressed the members of the New England Foundrymen's association at a meeting held in the Exchange club, Boston, Dec. 10, with reference to the industrial unrest problem and its solution.

E. R. Ritter who has been assistant works manager for the Lunkenheimer Co., Cincinnati, for the past four years, has resigned and is now president of the Hill & Griffith Co., Cincinnati, manufacturer of foundry facings.

H. H. Harris, formerly general sales manager for the Swedish Crucible Steel Co., has been appointed manager of the heat-treating equipment department of the Quigley Furnace Specialties Co., New York. Mr. Harris has had a number of years experience in the application of heat-treating materials, especially mixtures and alloys for carbonizing and annealing boxes and cyanide pots.

E. J. O'Connell, vice president of the Deister Concentrator Co., Fort Wayne, Ind., addressed the members of the Philadelphia Foundrymen's association at a meeting held Dec. 10, on the subject of reclaiming metal from ashes, slag and sweepings, in brass and bronze foundries.

J. Frank Muller has resigned his position as foundry foreman for McCord & Co., West Pullman, Ill., and has removed to Almonesson, N. J.

W. E. Seymour, who for the past six years has been general superintendent of the Eclipse works of Fairbanks, Morse & Co., Beloit, Wis., and who previously was with the Ford, Cadillac and Buick companies, has become associated with the A. O. Smith Corp., Milwaukee.

H. H. Huyett has been re-elected president of the Reading Car Wheel Co., Reading, Pa. The other officers of the company are W. C. Mullett, secretary-treasurer; and John W. Bowers, general manager.

WILLIAM MALCOLM CORSE

B. Frank Hiestand, who has been connected with the Marietta Casting Co., Marietta, Pa., has been elected vice president of the Pulaski Iron Co., Philadelphia. Mr. Hiestand succeeds W. H. Gibbons, who resigned recently. Harry C. Griefzau has been elected secretary-treasurer, succeeding Mr. Gibbons who also held those offices.

George J. Simonds, who until recently was head of the experimental and pattern departments of the Moreny-Van Buren Mfg. Co., Sturgis, Mich., manufacturer of plumbers' brass castings, now is employed in similar lines by the Cushman Auto Tool Co., Champaign, Ill.

Charles J. Siegle has resigned his position as general foreman with the Detroit Steel Casting Co., Detroit, to become assistant superintendent for the Canton Steel Foundry Co., Canton, O. Mr. Siegle was general foreman of the Canton foundry for a number of years and returns to take up work with his former company after two years' absence.

Howard Robinson, formerly foundry foreman with the Waterloo Gasoline Engine Co., Waterloo, Iowa, has resigned to become foundry superintendent of the new foundry being erected by the George B. Miller & Son Co., Waterloo.

Richard M. Van Gaasbeek, head of the department of foundry, Pratt institute, Brooklyn, was the speaker at a recent luncheon of the Gray Iron club, of New York. Mr. Van Gaasbeek discussed the needs and possibilities for training foundry workers and urged the necessity for employers to co-operate and advise with the schools in their efforts to be of service to them in the training of men already employed and in attracting new men to the industry.

Alexander C. Brown, president of the Brown Hoisting Machinery Co., of Cleveland, has been elected president of the northeastern Ohio division of the National Safety council.

H. K. Pollard has resigned as sales manager of the Bayonne Steel Casting Co., Bayonne, N. J., to become sales manager of the Deemer Steel Casting Co., Newcastle, Del.

O. K. Carpenter, formerly with the Bayonne Steel Casting Co., Bayonne, N. J., now is superintendent of the Millbury Steel Foundry Co., Millbury, Mass.

Book Review

Foundry Cost Accounting, by Robert E. Belt, cost accountant of the American Malleable Castings association, Cleveland, O.; cloth, 271 pp., 8½ x 5½ inches; published by the Penton Publishing Co., Cleveland, and furnished by THE FOUNDRY for $5 net.

This book sets forth in a simple and direct manner, for the guidance of the foundry cost accountant, practical principles of accounting that are applicable to the foundry industry. It also shows methods of collecting the cost data and of determining production costs accurately. The author throughout has accented the importance of an accurate knowledge of costs and the dangers of a price policy that is not founded on production costs. The description essential to a clear presentation of the subject, while

omitting no important details, is brief and concise.

It is not claimed that the procedure outlined is exactly suitable to all foundries. It is claimed, however, that with minor adaptations, the principles, the forms, the classification of accounts, the methods of distributing overhead expense, and the procedure in determining the cost of individual jobs or classes of work may be used in a satisfactory manner by practically every foundry.

The author goes into detail in discussing conditions necessary for the successful operation of cost systems. The accounting practice and procedure pertaining to the purchase and recording of materials and supplies, and the recording of labor costs is illustrated with numerous sample forms. Fifty-two pages are devoted to operating departments and department records. This chapter is also profusely illustrated with sample forms. Classification of accounts with illustrations showing the method of adoption in iron, steel and malleable foundries is dealt with extensively through 67 pages.

Monthly statements, product costs, depreciation, estimates and quotations and profits, are each taken up in turn and a definite and practical method for handling them is recommended. The book concludes with a comprehensive index alphabetically arranged.

Will Make Equipment for Heat Treating

The Quigley Furnace Specialties Co., New York, now is manufacturing a complete line of carbonizing pots and annealing boxes for heat-treating. These products are made of special-analysis steel, designed for maximum resistance to oxidation, coupled with minimum cost per heat-hour of service. In addition to this regular line, the company will market two other special alloys for similar work where the operating conditions require a special material.

Study Haulage Problems

As an inducement to industrial plant managers, engineers and others to study inter-department transportation problems and particularly the use of industrial tractors and trucks to conserve labor and increase production, an offer of three awards for the three best analyses of the application of their new tier-lift truck is announced by the Lakewood Engineering Co., Cleveland. The new truck combines a tiering machine with a storage battery truck, thus making a load-carrying unit that will, by electric power, elevate its 2-ton load to any height up to 76 inches from the floor. Three awards—$1000, $500 and $250—are offered for the three best papers on the application of the truck. Details of the contest will be sent by the Lakewood Engineering Co., Cleveland, upon request.

Stanton S. Freeman, receiver for the Seaboard Steel & Manganese Corp., has been authorized by the court to operate one of the blast furnaces of this company at Temple, Pa., in the production of foundry pig iron. The furnace is to go in blast immediately and the output is expected to be 4000 to 5000 tons per month. The iron will be disposed of by the Debevoise-Anderson Co., and by Philip E. Wright.

What the Foundries Are Doing

Activities of the Iron, Steel and Brass Shops

The Lexington Motor Co., Connersville, Ind., is reported planning the erection of a foundry.

Erection of a foundry building, 100 x 200 feet, is plated by the Cox Brass Mfg. Co., Albany, N. Y.

Plans for remodeling its foundry have been prepared by the Ohio Brass Co., Bucyrus, O.

The Eastern Malleable Iron Co., New Britain, Conn., is reported planning the erection of a building.

The Peerless Foundry Co., Cincinnati, recently increased its capital from $200,000 to $500,000.

Erection of a foundry building, 100 x 200 feet, is contemplated by the Monarch Foundry Co., Detroit.

A power plant will be erected by the Trenton Malleable Iron Co., Trenton, N. J.

The Dayton Castings Co., Dayton, O., according to a report, contemplates the erection of a plant.

The Penobscot Foundry Co., Main street, Bangor, Me., contemplates improvements to its plant.

The Detroit Gray Iron Foundry, Detroit, is erecting an addition to its foundry.

Erection of a building, 45 x 211 feet, is planned by the American Stove Co., Cleveland.

Contractors have started work on the erection of a foundry building addition to the plant of the Packard Motor Car Co., Detroit.

Erection of an addition to its foundry building, is contemplated by the Advance Stove Works, Evansville, Ind.

Plans have been prepared for the erection of a foundry 62 x 106 feet, for the National Smelting & Refining Co., Detroit.

The Dane Machine Co., Salem, Mass., recently was incorporated with $50,000 capital to operate a foundry and machine shop, by J. W. Dane, F. L. Warner, John Little, C. and Joseph H. Poor and others of Danvers, Mass.

The Durkon Castings Co., 110 West Bayard street, Dayton, O., is expected to take bids soon for the erection of an addition, 40 x 97 feet.

The State Foundry Co., 116 Atlas street, Akron, O., is reported contemplating the erection of a foundry, 80 x 100 feet.

Capitalized at $4000, the City Metal Casting Co., Elyria, O., recently was incorporated by C. A. Dawson, James Melet and others.

The Northern New York Foundry & Machine Co., Glens Falls, N. Y., recently increased its capital stock from $25,000 to $50,000.

Contracts have been awarded by the Maumee Malleable Castings Co., Toledo, O., for the erection of plant additions and improvements.

W. H. Smith, 66 Taylor road, East Cleveland, O., plans the erection of a plant to include a foundry and machine shop, to be 100 x 121 feet.

The Moore Bros. Co., Joliet, Ill., Lewis Moore, president, is reported planning the erection of a foundry, 67 x 70 feet.

The Elmira Foundry Co., Elmira, N. Y., is reported planning the erection of a foundry, 80 x 80 feet.

The Troy Iron Works, Watervliet, N. Y., is reported contemplating the erection of a foundry, 108 x 200 feet.

Capitalized at $3000, the Beggs Foundry Co., Bessemer, Ala., recently was incorporated by Oscar Cochanel, J. P. Beggs and others.

The Hammond Malleable Iron Co., Hammond, Ind., has bought 25 acres adjoining its plant, on which it contemplates the erection of future plant additions.

Contracts for the erection of a foundry have been awarded by the Perseverance Foundry Co., Philadelphia.

Capitalized at $30,000, the Mason City Foundry & Machine Co., Mason City, Iowa, recently was incorporated by R. E. Wilcox, L. G. Dreyer and others.

The capital stock of the Motor Castings Co., South Bend, Ind., recently was increased from $30,000 to $45,000.

Contractors are erecting a foundry and cupola building for the Globe Metal Products Co., Sheboygan, Wis.

Work has started on the erection of an addition to the plant of the Troy Foundry & Machine Co., Troy, N. Y.

The American Foundry Equipment Co., 110 South Dearborn street, Chicago, is reported planning the erection of a building to be 100 x 300 feet.

The American Skein & Foundry Co., Racine, Wis., manufacturer of cast iron and malleable iron skeins, is erecting a small addition to its plant.

Plans have been prepared for the erection of a new plant for the Specialty Foundry Co., Portland, Oreg. The building will be of frame construction.

The Samson Tractor Co., Janesville, Wis., now erecting a large foundry, has announced plans for the erection of two others of similar dimensions.

The Marion Gray Iron Foundry Co., Marion, Ind., reported planning the erection of a plant addition, 54 x 122 feet.

The Union Steam Pump Co., Battle Creek, Mich., is expending $200,000 for new buildings and equip-

ment. Extensions include a machine shop and foundry.

Henry P. Mueller, 215 Lombard street, St. Louis, has had plans prepared for the erection of a foundry building.

The Dangler Stove Co., 5017 Perkins avenue, Cleveland, plans the erection of an addition to its plant, 50 x 200 feet.

A. Lincoln Frame, 403 South Fifth street, Reading, Pa., plans the erection of an addition to his foundry, 60 x 92 feet.

A foundry, 50 x 150 feet, will be erected by the Millville Cast Iron Products Co., Millville, N. J. Other improvements are contemplated.

Erection of an addition to its plant is contemplated by the Manufacturers Foundry Co., Waterbury, Conn. The building will be 100 x 153 feet.

The Buda Motor Co., Harvey, Ill., has plans for the erection of a foundry. The building will be 40 x 160 feet.

Fire recently damaged the plant of the Atlantic Foundry Co., near Cuyahoga Falls, O. It will be rebuilt.

The Gray Iron Foundry Co., Reading, Pa., of which A. L. Frame, is president, has placed a contract for the erection of a foundry extension.

Contracts have been placed by the Birdsboro Foundry & Machine Co., Birdsboro, Pa., for the erection of an extension to its plant, to be 60 x 187 feet.

The Freeland chamber of commerce, Freeland, Pa., according to a report, will aid the Freeland Foundry & Machine Co., whose plant was damaged by fire some time ago.

The Prime Mfg. Co., 1218 Railway Exchange building, Milwaukee, manufacturer of brass castings and railroad supplies, recently increased its capital from $40,000 to $75,000.

Contractors are rushing to completion work on the erection of a new foundry for the Delta Foundry & Machine Works, Delta, Pa., to replace the building recently damaged by fire.

The property of the Findlay Iron & Coal Co., Findlay, O., has been purchased by the Findlay Engineering & Mfg. Co., and the new owner plans the immediate erection of foundry building additions.

Work has started on the erection of a foundry building addition for the Hinderer Bros. Co., Twentieth street and the Wheeling & Lake Erie railroad tracks, Canton, O.

Ground has been broken for the erection of a new plant for the Whitmore Machinery & Foundry Co., Menasha, Wis. The plant will be 60 x 116 feet and will be equipped with a traveling crane.

The Northwestern Iron Works, Devils Lake, N. Dak., has had plans prepared for the erection of a plant to include a machine shop, foundry, pattern shop, tin shop, blacksmith shop, etc.

Production facilities of the Standard Casting Co., Lansing, Mich., have been increased 50 per cent, through the purchase of the plant of the Thomas Milling Co.

The Rockford Mfg. Co., Rockford, Ill., manufacturer of agricultural implements, has advised that at present it is employing about 25 molders, but expects to increase the number to 50 or 60 molders.

The Pelton Steel Co., Milwaukee, has sold its plant to the Stowell Co., manufacturer of steel and iron castings. It is said the plant will be operated by the Stowell Co. as a branch malleable iron foundry employing 200 men.

The Malleable Iron Range Co., Beaver Dam, Wis., will build a plant addition, 70 x 145 feet. The general contract has been let to the Hutter Construction Co. Engineers in charge are Lockwood, Greene & Co.

The Gardner General Foundry Co., Gardner, Mass., will build a foundry, 50 x 130 feet, to replace one damaged by fire some time ago. It will be equipped with two 5-ton and four 2-ton traveling cranes. The cupola building will be extended 40 x 46 feet.

The Franz Foundry & Machine Co., recently incorporated at Akron, O., with $400,000 capital, has taken over the Triumph Machine Shop, Barberton, O., and will manufacture rubber making machinery. Officers are: President, C. Franz; vice president, Criss W. Franz; secretary, J. A. Brittain, and treasurer, Ward H. Parry.

Contracts have been awarded to the H. D. Best Co., 949 Broadway, New York, for the erection of an addition to the plant of the American Machine & Foundry Co., Brooklyn, N. Y. The proposed building will be 100 x 192 feet with an ell, 30 x 40 feet.

The Empire Tube & Steel Corp., New York, recently was incorporated with $450,000 capital, to manufacture cast iron and steel pipe castings, forgings, etc., by H. V. Crawford, G. C. Sprague and A. H. Warren, 120 Broadway.

The Lucey Mfg. Co., Houston, Tex., contemplates the erection of a plant to include a gray iron foundry, forge shop, steel works, etc., and will consist of eight units. The company manufactures oil-well machinery.

Bernard C. Putnam, H. Monro Dunham and Eugene Jordan, all of Grand Rapids, Mich., recently incorporated in Delaware, the Welded Products Co., to manufacture cast iron, bronze, etc. The company is capitalized at $100,000.

The Almont Mfg. Co., Almont, Mich., recently was incorporated with $25,000 capital and has taken over the Almont Foundry for the production of light gray iron semisteel castings. Charles D. Ferguson is president.

Announcement has been made of the sale of the plant of the Whiteley Malleable Castings Co., Muncie, Ind., to the recently organized Muncie Malleable Foundry Co. The new company, which was formed by a number of Michigan capitalists, is capitalized at $1,000,000.

The Crawfordsville Foundry Co., Crawfordsville, Ind., will build a plant to include a foundry and machine shop. The entire plant will consist of three buildings, 1 story, 60 x 80 feet, 2 stories, 60 x 80 feet and 1 story, 20 x 40 feet. C. W. Coons, Chamber of Commerce, is interested in the project.

The Baldwin's Canadian Steel Corp., Ltd., Toronto, Ont., has been incorporated by James S. Lowell, 25 King street, West, William Bain, Robert Gowans and others with $500,000 capital. The company has taken over the plant of the British Forgings, Ltd., Ashbridge Bay, Toronto, and is putting it in order and building an addition for the manufacture of iron, steel, castings, bars, blooms, billets, tinplate, etc.

An extension to the Belmont foundry of the Link-Belt Co., Chicago, located at Indianapolis, consists in completing new furnace building, Nos. 7 and 8; but for the present only one furnace will be installed and that in building No. 7. This furnace will be of 15 tons capacity. The company is purchasing necessary machinery and equipment, including sand blast and other foundry equipment. The buildings will be 70 x 400 feet.

The first unit of the Lumen Bearing Co., Buffalo, brass founders, of their proposed plant to be erected at Youngstown, O., will be 105 x 140 feet, and will have an output of 2,000,000 pounds of brass castings yearly. As the plant is expanded an additional unit is to be added, and the first unit relieved of its stoves and other departments, by the construction of a third building to be known as a store room. The company expects that the two units with the store room, will have an output of 5,000,000 pounds of brass castings a year, in addition to 2,500,000 pounds of babbitts and solders.

Contractors have started on the erection of an addition to the plant of William Dennick & Co., 1415 East Fifth street, Dayton, O., manufacturers of heavy and light bronze castings. The addition will be two stories, the upper floor to be used as a core room, dressing room and racks for core boxes. The lower floor will be divided into two sections, one section to be used for general office purposes, while the other will be used for machinery and shipping rooms. In addition to the building, the company is improving other plant departments by the installation of modern equipment. William Dennick Jr. is one of the company officials.

New Trade Publications

ELECTRIC DRILLS.—The Independent Pneumatic Tool Co., Chicago, is circulating an illustrated leaflet in which electric drills and grinders are described and illustrated. According to the leaflet these tools can be operated from any electric lamp socket.

MICROSCOPES.—The Bausch & Lomb Optical Co., Rochester, N. Y., recently published the 28th edition of its microscope catalog, which contains data, specifications and illustrations of microscopes for various work, including metallurgical research. Two types of microscopes for metallurgical work are described.

ROLLED ZINC.—The uses and characteristics of rolled zinc are featured in an 8-page booklet being circulated by the New Jersey Zinc Co., New York. The uses to which this material is put are given and include its use for boiler plates, building hardware, screens, shingle nails, machine plates, etc. Several illustrations are given.

BRASS DIE-CASTINGS.—An interesting description of alloy castings made by a patented process is given in a 20-page booklet published by the Doehler Die-Casting Co., Brooklyn. Beside describing the advantages of castings made by this process the booklet also shows cuts of many die-castings used in different lines of manufacture, such as parts for automobiles, guns, steam turbines, cream separators, etc.

MICROSCOPES.—A 4-page folder has been published by Holz & Co., Inc., New York, describing 1920 microscope outfits. According to the leaflet a complete outfit permits photos under magnification from 1 to 3500 x. Both forms of vertical illuminators are contained and the focusing movement is separated from the base, which according to the leaflet, represents an advance in the design of metallographic microscopes. Other points of this equipment are given.

AIR COMPRESSORS.—Two bulletins have been issued by the Ingersoll-Rand Co., New York, calling attention to the use of air compressors. One bulletin is a cardboard folder and is devoted to the air lift method of pumping water. This bulletin contains a postcard questionaire. The second leaflet calls attention to two catalogs issued by the company, Nos. 3230 and 3131. The former describes belt driven compressors while the latter points out the details of the steam driven type.

AIR COMPRESSORS.—A 10-page booklet is being distributed by the Ingersoll-Rand Co., New York, in which air compressors for belt drive, are described and illustrated. The type described is the vertical, single stage, single acting, self-oiling, enclosed, center crank design, and consists of a sturdy main frame, which encloses the main bearings, crankshaft and connecting rod. The air compressing cylinder is on the top of the main frame, to which it is secured by suitable stud bolts. Full details are given.

FOUNDRY SUPPLIES.—A cloth-bound catalog has been published by Frederic B. Stevens, Detroit, in which complete foundry supplies are listed, described and illustrated. The book is not only a catalog, but is also a reference book, containing valuable information relating to foundry materials, electroplating supplies, firebrick and their respective uses. The foundry supplies described are: Oils, sand, etc.; cupola furnace; pressure gages; blast volume meter; blowers; elevators; general foundry tools; sand mixers; molding machines, etc. Complete data pertaining to each article or material are given and all equipment is illustrated.

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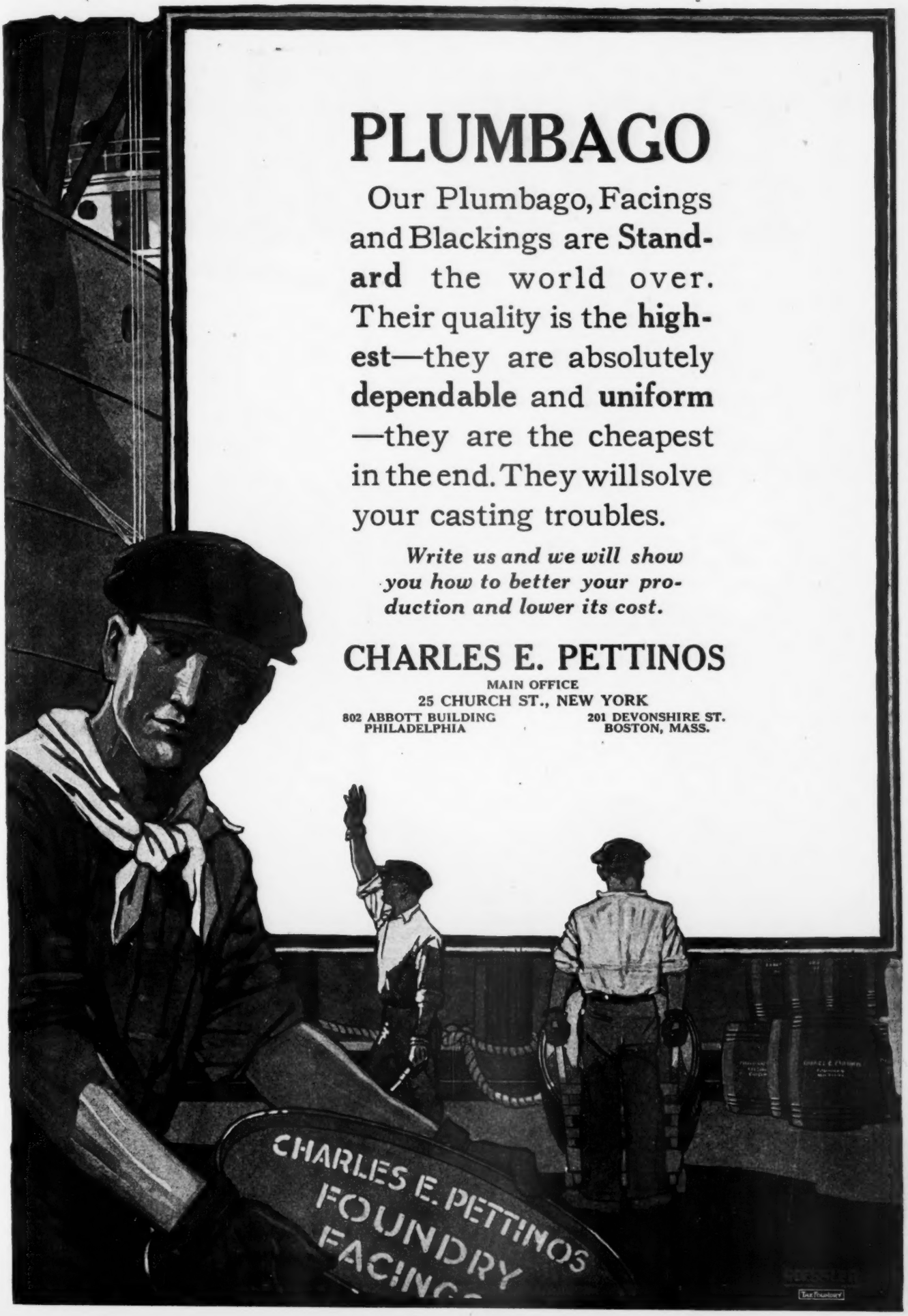

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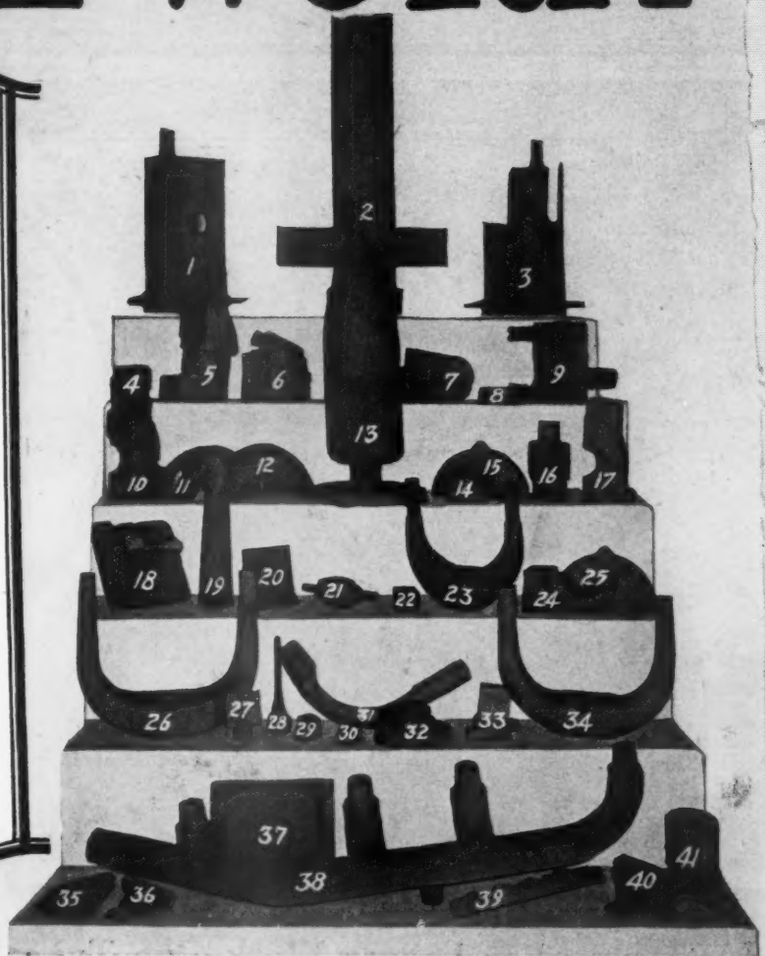

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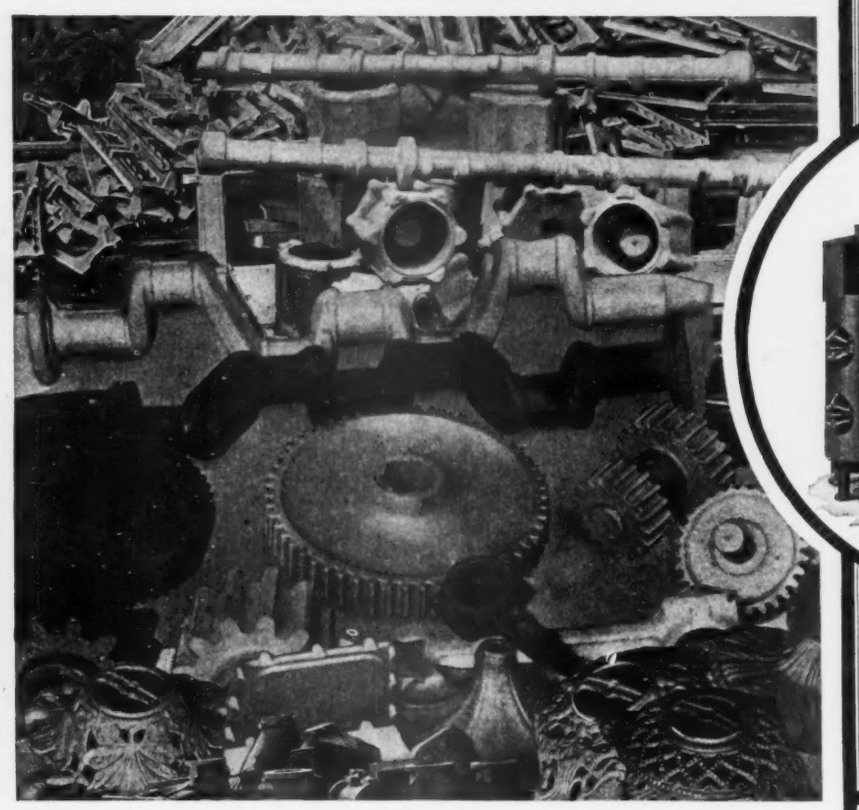

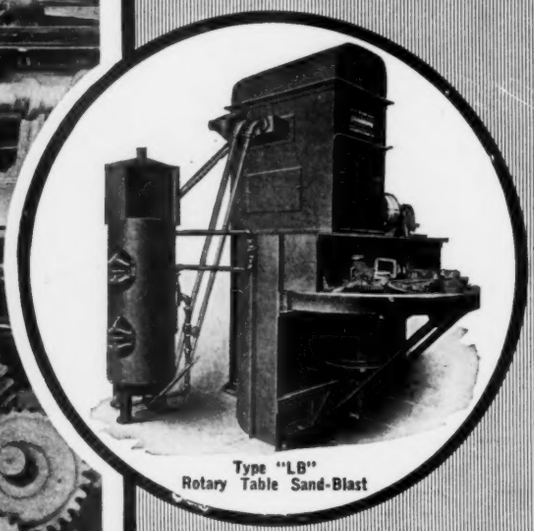

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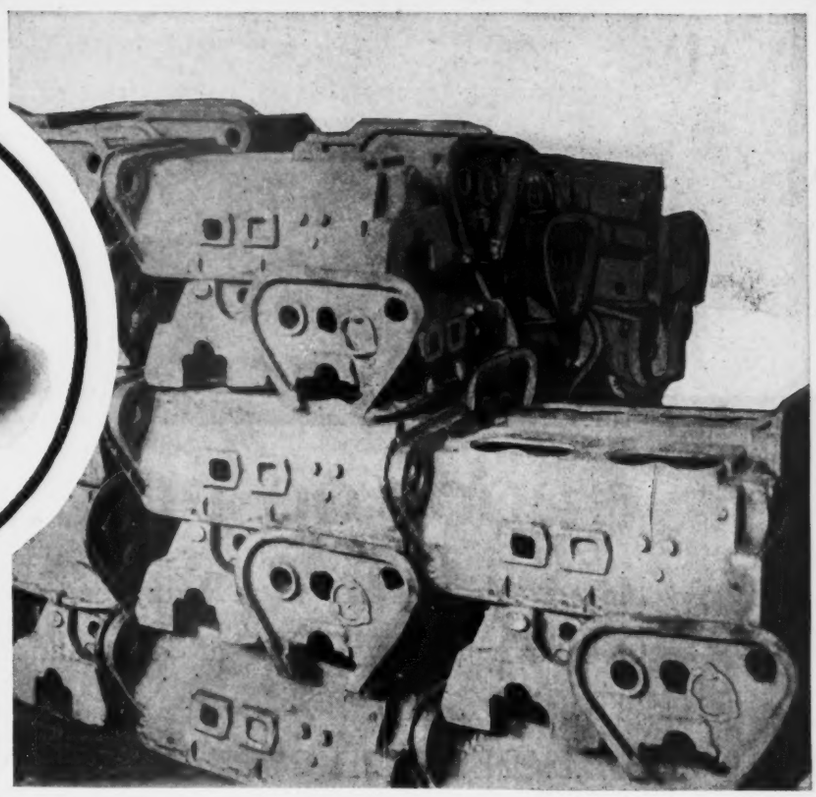

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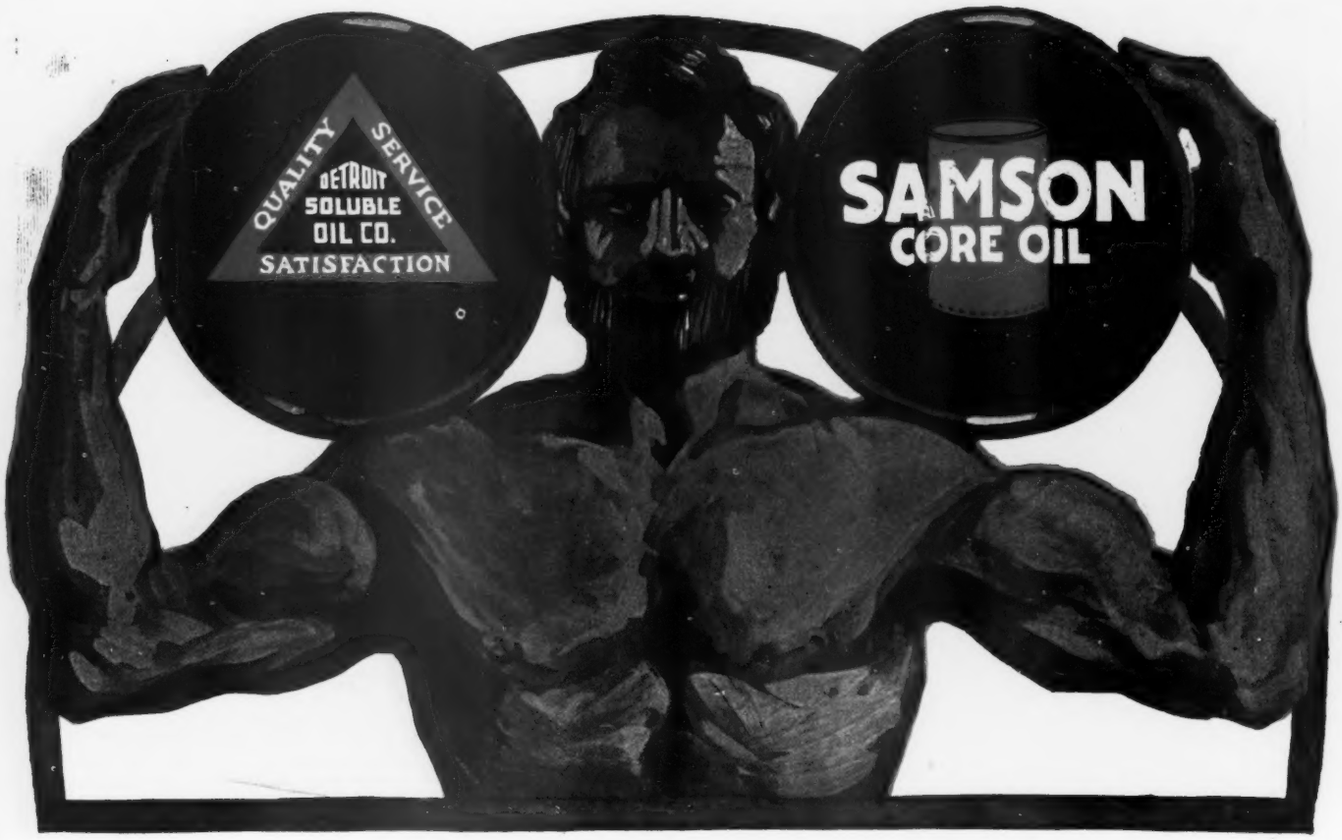

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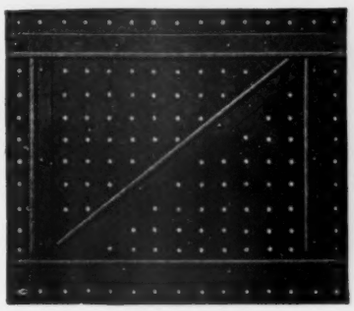

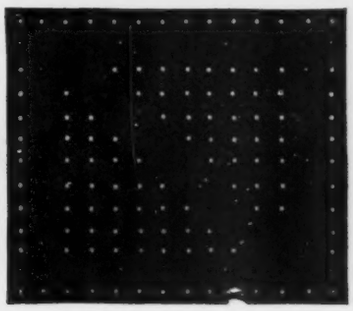

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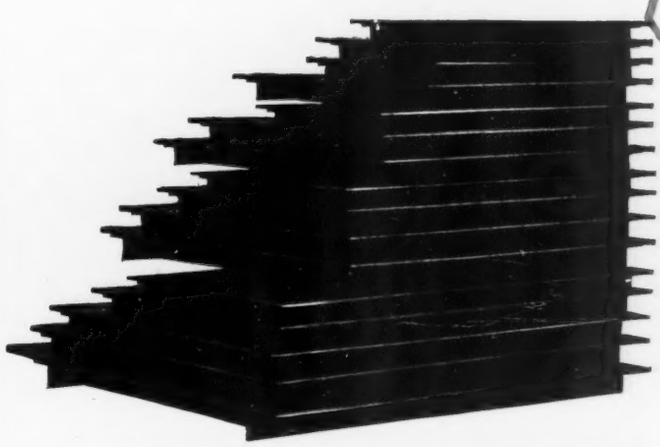

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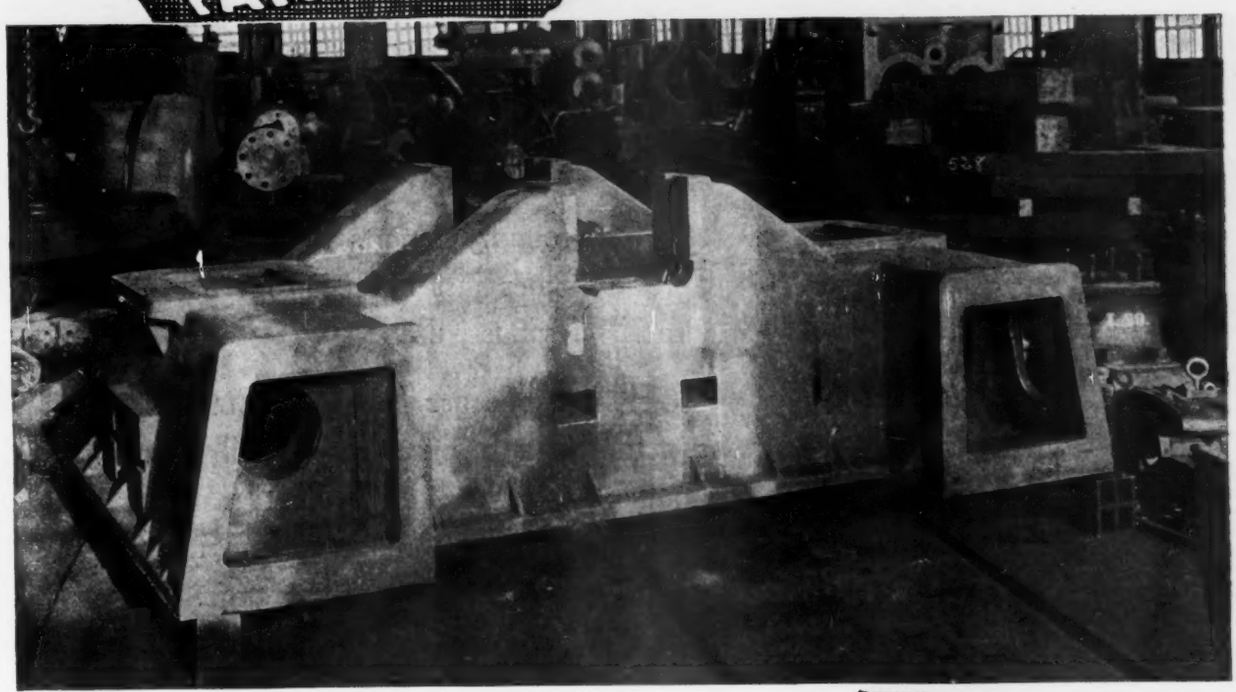

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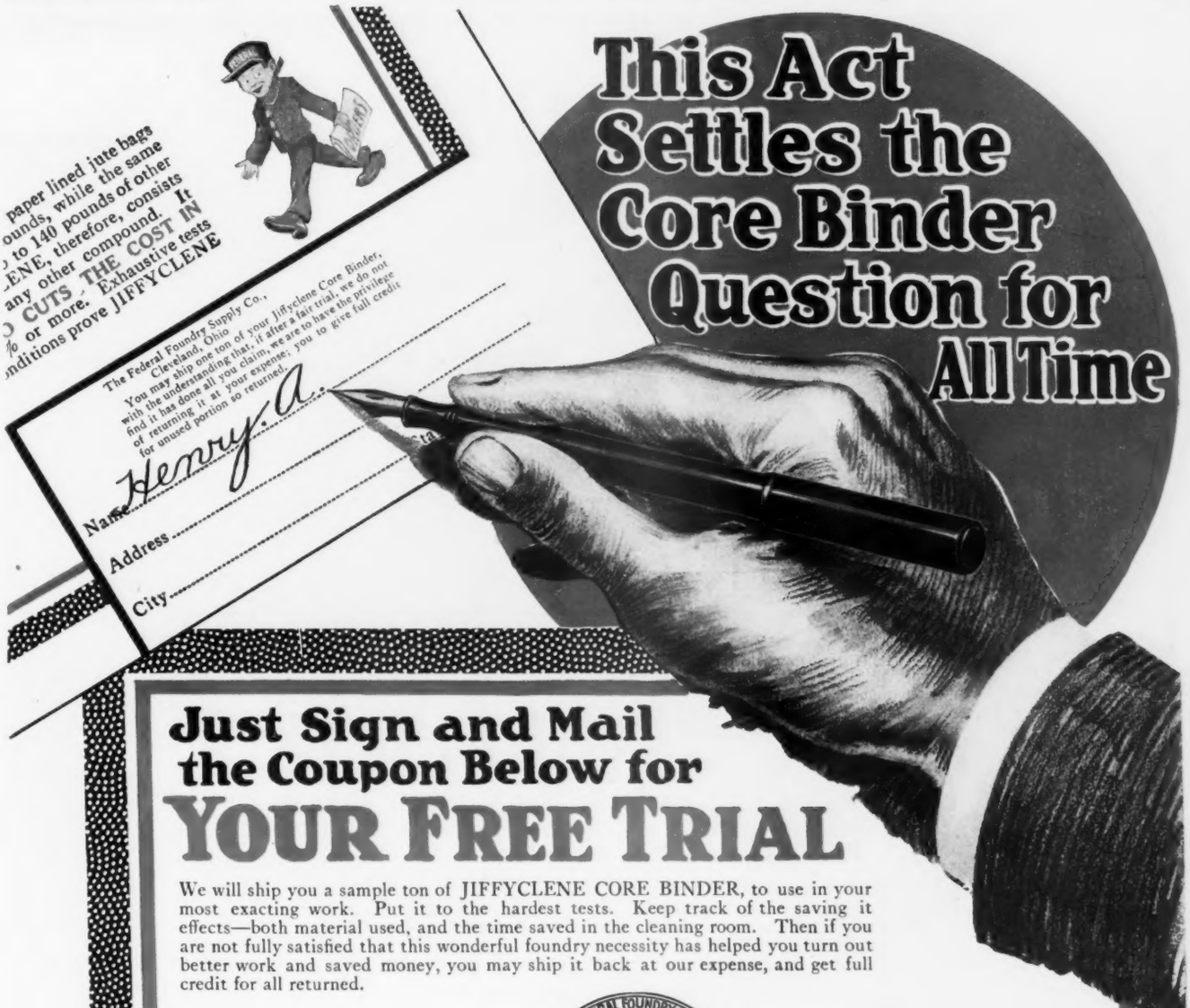
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is a newly improved core binder that makes stronger, better cores, at less cost. It is composed of pure pitch in combination with other strong binders, all air floated, producing a high degree of fineness and lightness with exceptional bulk. This results in an increase in the binding ratio and a 30% decrease in the quantity required. It produces less smoke, so does not interfere with operator's comfort.

JIFFYCLENE is made with mechanical precision and is always uniform. The Federal process combined with the perfect blend of the excellent gum binders used, has created remarkable popularity for JIFFYCLENE. This binder is five times as efficient as flour, costs less, and resists highest pouring temperature. Excellent as a dry sand facing. Produces a surface so durable that it is impossible for the metal to cut in and scab.

JIFFYCLENE is extremely bulky; the paper lined jute bags in which it is packed, hold but 100 pounds, while the same size bags will accommodate from 125 to 140 pounds of other core binders. A ton of JIFFYCLENE, therefore, consists of 4 to 5 BAGS MORE than any other compound. It releases in half the time and so CUTS THE COST IN THE CLEANING ROOM 50% or more. Exhaustive tests and continued use under all conditions, prove JIFFYCLENE the peer of all binders.

Decide Now—Mail the Coupon

The Federal Foundry Supply Co.
Home Office and Works
CLEVELAND, OHIO
Branch Offices and Warehouses:
PHILADELPHIA DETROIT MILWAUKEE
SAN FRANCISCO SEATTLE

THE FEDERAL FOUNDRY SUPPLY CO.,
CLEVELAND, OHIO

You may ship one ton of your Jiffyclene Core Binder, with the understanding that, if after a fair trial, we do not find it has done all you claim, we are to have the privilege of returning it at your expense: you to give full credit for unused portion so returned.

Name.....

Address.....

City..... State.....

BEST BY TEST

HITS THE MARK

"KELCO" CEYLON LEAD

WE GUARANTEE THIS TO BE
THE BEST LEAD FACING
ON THE MARKET

ORDER A BARREL ON APPROVAL

STOP BAD CASTINGS
SAVE LABOR LOSSES
CUT CLEANING COSTS

IF NOT AS GUARANTEED
RETURN AT OUR EXPENSE

FAIR—ISN'T IT?

CARRIED IN STOCK

Ceylon Lead	Core Oil	Pitch Compound
Silver Lead	Molasses	Galvanized Pails
Plumbago	Soft Brushes	Wooden Buckets
Graphite	Wire Brushes	Wooden Mallets
Core Wash	Coke Forks	Rawhide Mallets
Blacking	Shovels	Bench Rammers
Seacoal	Scoops	Floor Rammers
Parting	Riddles	Goggles
Gluttrin	Bellows	Gloves
Goulac	Chaplets	Swabs
Flour	Torches	Fillet

ESTABLISHED 1885

T. P. KELLY & CO., INC.

355 WEST 26TH STREET
NEW YORK

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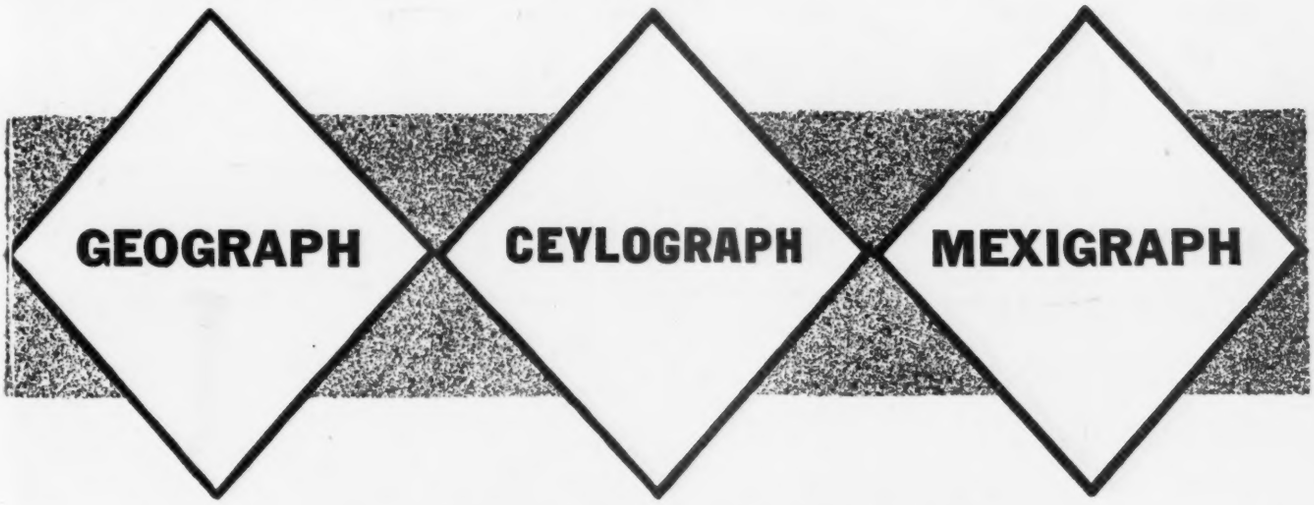


ALBANY SANDS
RELIABLE SERVICE

SANDS

Delivered by Boat or Rail

ALBANY—NORTH RIVER—JERSEY AND LUMBERTON MOULDING SAND

STRONG SAND—SHARP SAND
FURNACE BOTTOM SAND

GENUINE MILLVILLE GRAVEL

SAND BLAST SAND—FIRE CLAY

MICA SCHIST
for lining Bessemer and Converter Cupolas

FACINGS

Try our Standards

GEOGRAPH

CEYLOGRAPH

MEXIGRAPH

Prices may change

QUALITY WILL REMAIN UNIFORM

ARMOR BLACKING

GEORGE F. PETTINOS

Boston Office
236 Old South Bldg.

Real Estate Trust Building
PHILADELPHIA, PA.

Cleveland Office
503 American Trust Bldg.

CORUL

The Scientific Binder that Meets the Twelve Requirements of Core Making.

Cores that shrink and warp waste metal

THOUSANDS of pounds of metal can be wasted before you realize it by cores that contract or warp out of shape. When a core contracts, **the walls of the casting are bound to be thicker.**

A very slight shrinkage may represent a great many pounds, particularly in a large casting. When you multiply the **extra metal** used in **one** casting by **several hundred** or **several thousand** castings, the loss runs into big figures.

Losses of this kind are impossible in foundries that use Corul. Cores made with Corul do not shrink. They are the same size after baking as when they came out of the core box. And even when stored away for long periods they do not contract or warp.

If your drafting room has figured on using a certain quantity of metal in a particular casting you can count on using just that much metal and no more if Corul is your binder.

Send us your order today for a trial barrel. We are prepared to make prompt shipments from our stocks in New York, Chicago, Philadelphia, Providence and Syracuse.

SWAN AND FINCH COMPANY
NEW YORK

Quality Lubricants Since 1853

Chicago Philadelphia Hartford Providence Syracuse

PERFECT CASTINGS

YOUR FOUNDRY'S BEST ADVERTISEMENT and most effective salesman. Your interest lies in turning out the greatest possible number of perfect castings, whether you make them for your own use or to sell.

Perfect castings result from perfect cores, and the formation of perfect cores depends upon your core oil. The perfect core oil is

Union Korbind Oil

—The giant of all Core Oils. Produces castings of the highest finish on all kinds of work. KORBIND OIL oxidizes and polymerizes uniformly, bakes quickly and disintegrates completely, without "blows" or obnoxious gases, and leaving no residue in the core box.

The use of KORBIND OIL will mean profitable economy—a saving of both time and expense in your foundry. Our demonstrator is prepared to prove these statements—advise us when he may call.

Union Petroleum Company
Philadelphia—Chicago

New York Pittsburgh Kansas City San Francisco

MOLTRUP'S

FLATTENED STEEL PATTERN PLATES

Plates are made any size or shape to fit your flasks

Moltrup's Steel Plates are cut to any size or shape you desire, with handles, lugs or vibrator extensions and punch or drill flask pin holes when required.

We make plates in any thickness —1/8" or heavier, depending upon the nature of the work.

—the most modern and efficient way to mount split or matched patterns.

—especially recommended by molding machine manufacturers.

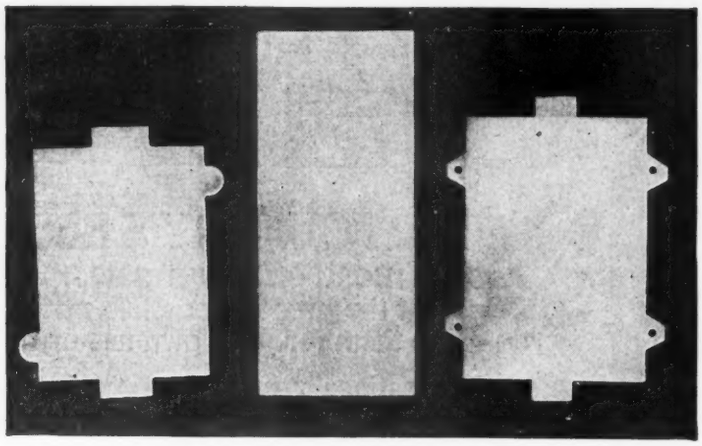
—will not warp, split or twist out of shape.

—light, rigid, strong.

—hammered, not machined.

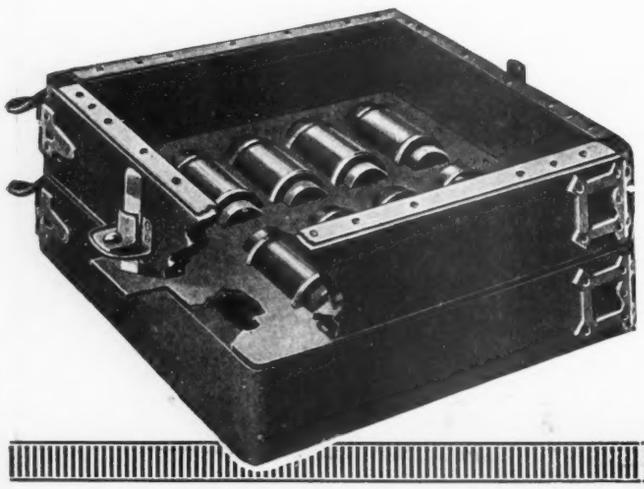
—cannot be sprung by handling or drilling.

Write for specification sheets—they simplify ordering.



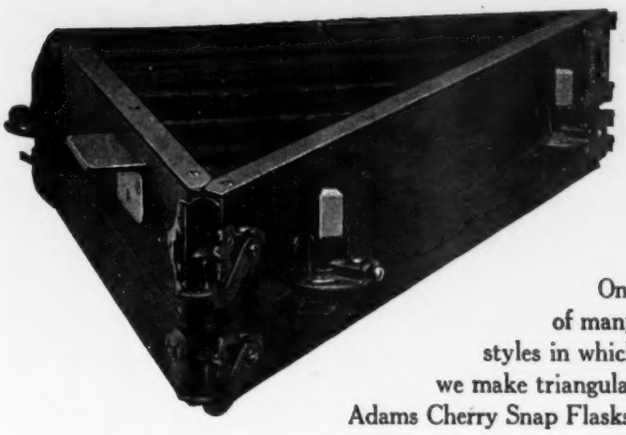
MOLTRUP STEEL PRODUCTS CO.

BEAVER FALLS, PA.



Manufacturers of

Flattened Steel Core Plates; Finished Circular Plates and Discs; Steel Engraving Plates; Cold Drawn Steel Bars; Shafting and Screw Steel; (hexagons, flats, squares and special shapes); Finished Machine Keys; Finished Machine Rack.



One of many styles in which we make triangular Adams Cherry Snap Flasks.

Round Adams Cherry Snap Flasks are glued up in laminations and turned accurately to size.

ADAMS CHERRY SNAP FLASKS

Adams Cherry Snap Flasks are the best that can be made — they never fall to pieces or get knocked to pieces by careless handling.

They are especially well adapted for squeezer work. They fit together correctly, and are so rigidly constructed that they will withstand an enormous pressure without springing.

All of our flasks are made up special to order, and can therefore be made exactly according to your specifications as to size, style, taper and trimmings. We can make any special shape you desire.

A man's size flask.

Adams Cherry Snap Flasks are made of 1⅛" selected, air-dried cherry lumber.

Corners are machined, locked, dipped in hot glue, forced together and held in a press until set.

Pins are of malleable iron (of any length), milled on the sides, and fitted with milled adjustable "V" blocks.

Malleable iron hinges milled at the joints.

Quick acting malleable iron snaps.

Provision for taking up wear in both hinges and snaps.

When you want a GOOD FLASK, Write

THE ADAMS COMPANY 175 Foster Street, Dubuque, Iowa, U. S. A.

BRANFORD PRODUCTS

$3.00 F. O. B. BRANFORD

Can be used as a sprayer for liquid as a plain air jet, without changing a single connection.

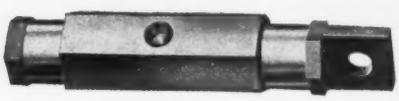
The "Branford" Cleaner and Sprayer

Simple, indestructible, efficient and economical.

Especially adaptable for speeding up the painting of castings, core spraying, mold spraying, bench, flask and pattern cleaning.

MIF TRADE MARK

The "Branford" Vibrator is guaranteed against all defective workmanship or material.



Made in 1/8" sizes from 3/8" to 2".

The "Branford" Vibrator

The vibrator with the kick. Made entirely of steel with all parts hardened and ground. It is an instant starter, and with reasonable care will last indefinitely.

Due to its accurate construction and its design, the "Branford" Vibrator is unusually economical in the consumption of air.

"Branford" Hose Clamp

The clamp with the tenacious grip.

It is easily applied and can be quickly removed with only the aid of a screw driver.

The best preventive for air leakage from loose connections.

MALLEABLE IRON FITTINGS CO., Branford, Conn.

Distributors "Branford" Vibrators and Accessories: Beryk Co., Cleveland; Buckeye Products Co., Cincinnati; Coates & Zarling, Milwaukee; Combined Supply & Equipment Co., Buffalo; Dayton Molding Machine Co., Dayton; Donald Mfg. & Supply Co., Milwaukee; Dominion Foundry Supply Co., Montreal, Que. and Toronto, Ont.; Foundrymens Supply Co., Milwaukee; Glen B. Hastings, Chicago; Hotchkiss & Co., Inc., Waterbury, Conn.; Kelly & Co., Inc., New York; Federal Steel Co., Detroit; New York Sand & Facing Co., Brooklyn, N. Y.; J. Jacob Shannon Co., Philadelphia; Snow & Galgiani, San Francisco; Whitehead Bros. Co., Providence, Buffalo; E. J. Woodison Co., Boston, St. Louis, Cleveland, Buffalo, New York, Detroit.

Speed 'er up

BY USING

SANDOIL

To speed up production of perfect castings it is necessary to have a good core.

A core that emits little gas, that can be removed easily and completely from the casting and one that will not cause bubbles and imperfections, can be made with the use of SANDOIL.

TEST IT YOURSELF

"Seeing is believing." That is why we are anxious that you should allow us to send you a trial barrel of SANDOIL.

Once you realize what SANDOIL will do, you will be glad to join the already large number of Sandoil boosters.

SANDOIL represents the last word in Core Oil perfection. It is the achievement of ten years experience in the manufacture of oil binders.

Sandoil is a comparatively new product but since its inception about a year ago it has gained much popularity.

"Economize by using the best" and you will profit by the experience of others. Therefore if you wish greater efficiency and reduced production costs in your foundry, just let us know and we will help you "speed 'er up."

THE GRACE-LYNN CO.

Formerly The Crawford Specialty Mfg. Co.

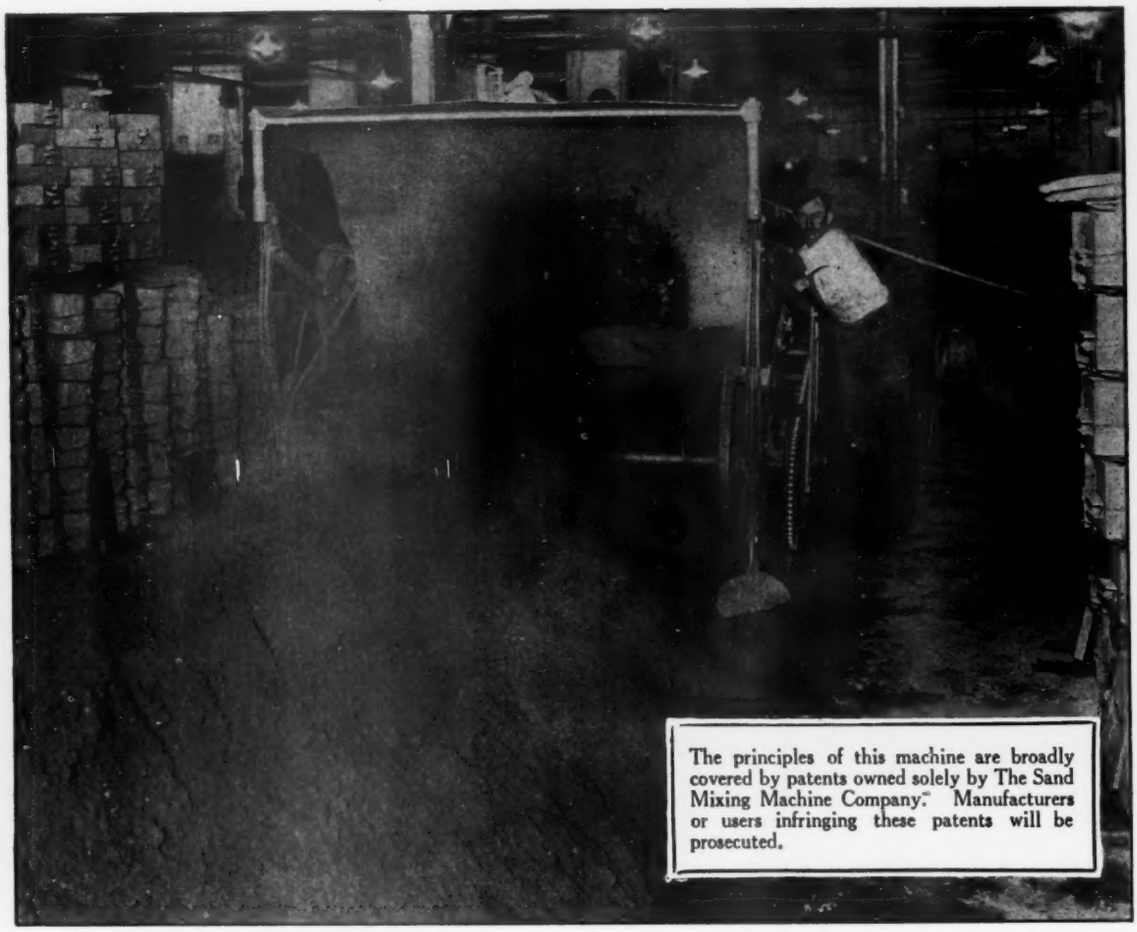
CLEVELAND, OHIO

Detroit Office, 718 Book Building

Stocks carried by

The Hill & Griffith Company	Cincinnati, Ohio
" " " " "	Pittsburg, Pa.
" " " " "	Birmingham, Ala.
" " " " "	Chicago, Ill.
Bennett & Seeley	Bridgeport, Conn.
Moline Sales Company	Moline, Ill.

CUTS -- MIXES -- PILES


The principles of this machine are broadly covered by patents owned solely by The Sand Mixing Machine Company. Manufacturers or users infringing these patents will be prosecuted.

The Auto Sand Cutter

Contrast with this, the crude stabbing that sand receives in shovel-cut-shops. Is it surprising that molders pick machine-cut-shops, where their work is all molding, not laboring, and the sand precisely right and uniform every day?

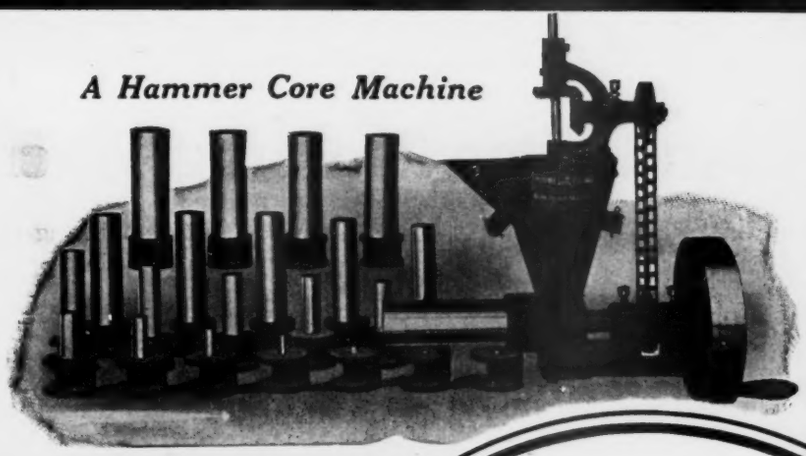
Do you wonder that efficient employers are swamping us with orders, to improve their production and escape exorbitant labor costs?

Upon inspecting your foundry, we will tell you candidly whether or not this machine would be of benefit in your business.

AMERICAN FOUNDRY EQUIPMENT CO.

Succeeding:
The Sand Mixing Machine Co. Rich Foundry Equipment Co.
52 Vanderbilt Avenue, New York City

A Hammer Core Machine



Cores-
Perfectly Formed by Cheap Labor

With this machine and the cheapest of labor, you can turn out large quantities of cores — uniformly packed and perfectly shaped—at a high rate of speed. The—

Hammer Core Machine

—either power or hand driven, does the work. It is made in three sizes, capable of producing standard cores in sizes ranging from 3/8" to 7" in width, and of any desired length. Special shaped cores can be made through special dies.

Write or wire for descriptive literature and further details

American Foundry Equipment Co.
Succeeding:
The Sand Mixing Machine Company and The Rich Foundry Equipment Co.
52 Vanderbilt Avenue, New York

Pridmore

Electrically Operated Molding

Electric Jolt Hand Strip Molding Machine

This machine is the last word in SPEED and EFFICIENCY. Made in the following sizes:

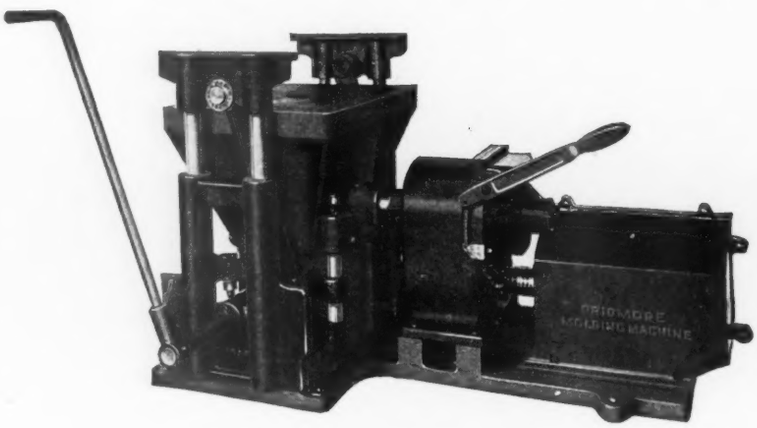
Table Sizes

16" x 20"—8" Lift
20" x 20"—8" "
20" x 24"—8" "
24" x 24"—8" "

All sizes require a one H. P. motor to operate same.

Prices of motors on application.

Advise kind of current available.



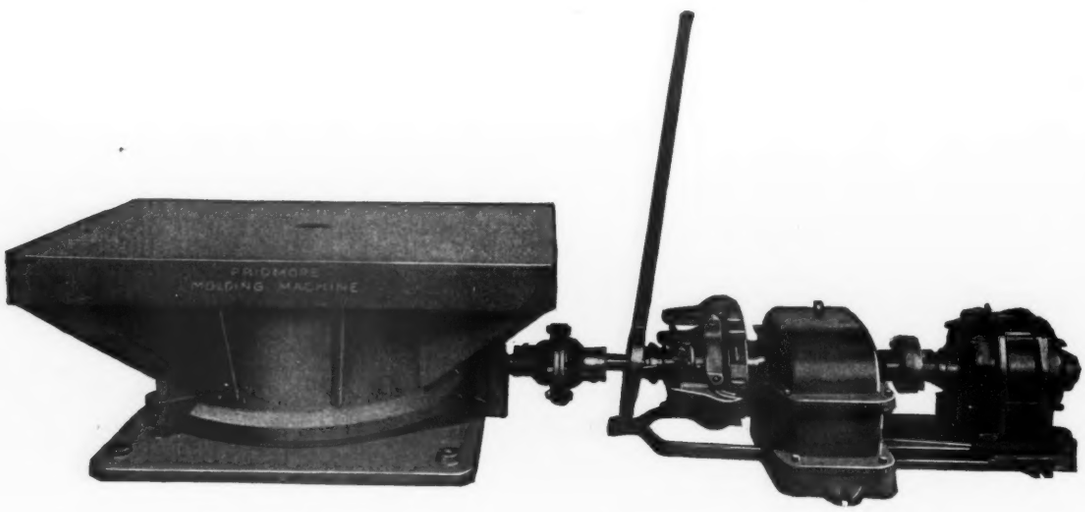
Distance between stripping arms is 1½" over length of table.
Capacity 250 pounds.

Height of Machine, floor to top of table 22".

Maximum size pattern is the size of jolt table.

Maximum size flask 4" greater than table size.

Efficiency, Durability, Low Operating Cost



The direct connected motor insures the highest degree of efficiency. All moving parts operate in oil bath.

The lift is always the same, every jolt is alike, therefore you count the jolts given each mold and the molds are rammed alike.

The operating cost is one-fifth the cost of air operated machines.

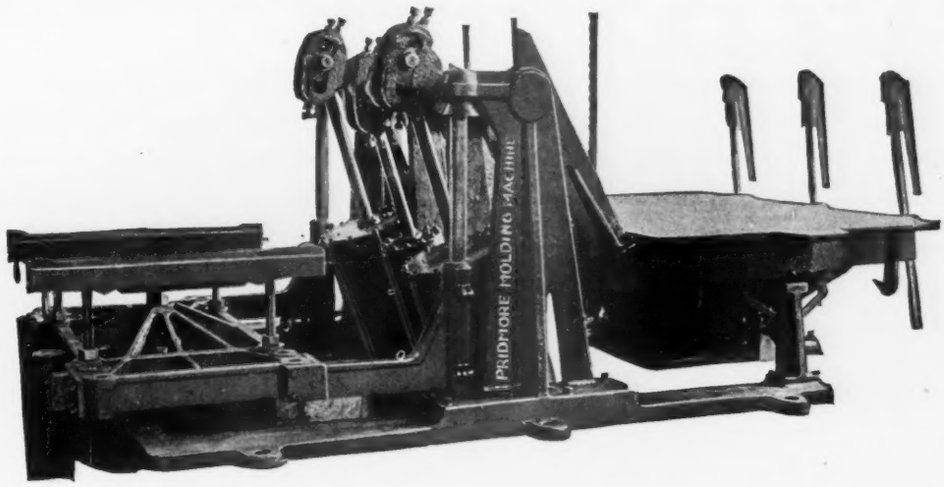
Made in sizes from 20"x20" table 500 lbs. capacity to 6'x9' table 50,000 lbs. capacity.

HENRY E. PRIDMORE 19th and ROCKWELL STREETS CHICAGO, ILL.

Machines Means Efficiency

Pridmore

Combination Electric Jar-Ramming and Air Power Rock-Over Machine



In manufacturing this machine we have taken in consideration the safety of operation by adding an oil check cylinder, or cushion free from all power. This cylinder is filled with oil and automatically engages as the frame or load passes over center and does not impede the speed of the machine, on the re-roll after drawing the pattern. It also has two 18" cylinders giving an enormous power. The draw is the same type as on all PRIDMORE POWER ROCK-OVER DROP Machines, oil cushion and three positive guides to insure absolute accuracy in drawing.

Combination Electric Jar-Ramming and Air Power Stripping Plate Machine

Table Sizes

30" x 48"—12" Lift
30" x 60"—12" "
36" x 48"—18" "
48" x 48"—18" "
36" x 72"—24" "
42" x 60"—24" "
60" x 60"—24" "

Distance between stripping arms 1½" over length of table.
Special sizes built to order.

HENRY E. PRIDMORE 19th and ROCKWELL STREETS CHICAGO, ILL.

If It's A Herman, It's Worth Using, It Made Its Way by the Way It's Made

The high cost of labor is going to necessitate, on the part of foundrymen, the installation of labor saving tools in order to produce castings economically.

The most economical production of molds on Herman Machines is unquestioned. Such castings as boiler sections, tractor transmission cases, journal boxes, hoisting engine castings, gun mounts, steel wheels for trucks, piston rings, gas engine cylinders, all types and sizes

A Herman Jarr, Independent Rollover and Pattern Draw Machine

of valves and fittings, car couplers, side frames and truck bolsters for cars, difficult housings, such as the Timken-Detroit Axle Housing, etc., are being made better and more economically on Herman Machines than on any other type. We stand ready to prove this assertion.

Please let us have your inquiry.

Herman Pneumatic Machine Company

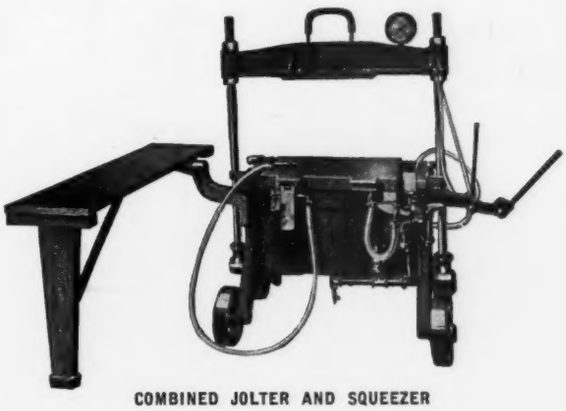
GENERAL OFFICES: Union Bank Building, PITTSBURGH, PA.

MANUFACTURING PLANT: ZELIENOPLE, PENNSYLVANIA, U. S. A.

Foreign Works: Pneumatic Engineering Appliances Co., Ltd., Palace Chambers, Westminster, London, S. W., Eng.

ARCADE
MOLDING MACHINES

MODERN MOLDING MACHINE

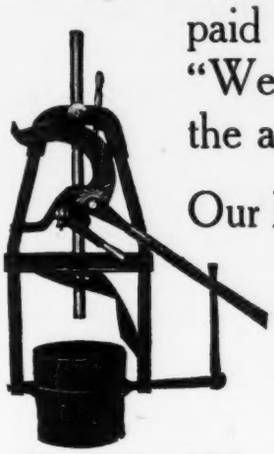


COMBINED JOLTER AND SQUEEZER

Not only the great time, labor and metal saving features, but their adaptability to all kinds of work, make Arcade Molding Machines and Labor Saving Foundry Equipment of the greatest value to every foundry.

With Arcade Devices, unskilled men and good boys are producing two, and often three, molds to the skilled hand molder's one.

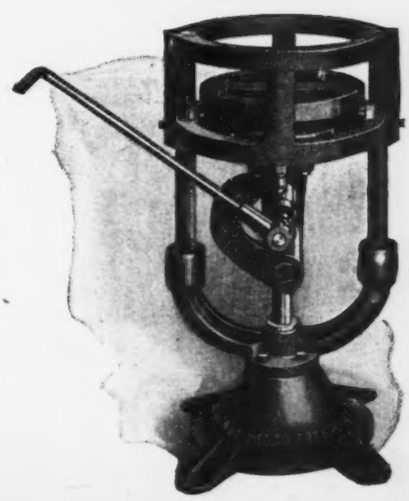
A large Milwaukee Manufacturer says, "Modern Molding Machine paid for itself in twenty-four days." Another writes, "We save 33 1/3% of our Machine expense because of the accuracy of the castings."



BRILLION 20TH CENTURY POURING DEVICE

Our Engineering Department will show you, without charge, just what Arcade Equipment will do in your foundry. If it won't save you money we won't let you buy it.

STRIPPING PLATE MACHINE

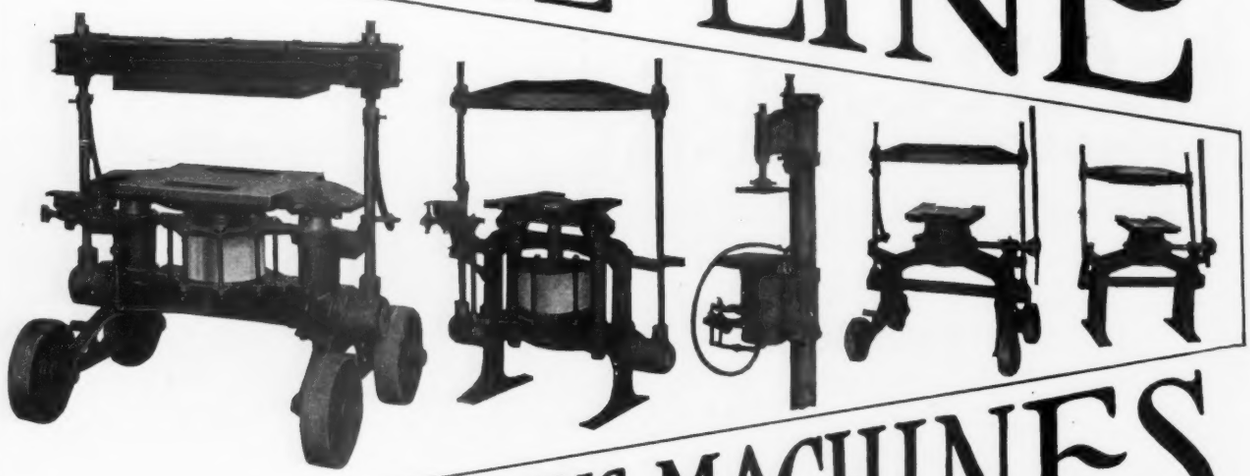


Write for complete illustrated Catalog

ARCADE MANUFACTURING CO.

Dept. D **FREEPORT, ILL., U. S. A.**

BEE LINE MOLDING MACHINES



Do the thinking for unskilled operators

The Bee Line are plain squeezers, operated by air and man power—Portable, Stationary and Post type.

Power machines have non-corroding brass cylinders, are air cushioned and have guide posts that take the strain off of the piston. They are fool and sand proof.

A new Catalogue of all types in preparation. Ask for it and get all the facts.

TRADE B B B MARK

THE B.&B. MFG. CO.
INCORPORATED
INDIANAPOLIS, IND.

Cleaning Castings–

Little Giant No. 4 Pneumatic Grinder, with 8-inch wheel at the plant of the Interstate Foundry, Cleveland, Ohio.

PUT a Little Giant Pneumatic Grinder in the hands of even the most inexperienced operator and he will clean castings properly, speedily and economically. The trigger control, the method of attaching the air hose, and the perfect balance of the No. 4 "Little Giant" here shown enable him to hold the tool with working comfort in any position and keep the work moving right along.

Holding the wheel too firmly against the casting in an effort to remove more metal works no injury to "Little Giants;" they "stall," resuming work when the pressure is properly relieved.

Little Giant Pneumatic Grinders economize on air, and eliminate lost time for repairs. They are quick-working machines which simplify casting cleaning operations to the extent of greatly reducing labor costs and increasing production.

Write for Bulletin 127

Chicago Pneumatic Tool Company, 1037 Fisher Building, Chicago

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BIRMINGHAM BOSTON BUFFALO CINCINNATI CLEVELAND DETROIT ELDORADO EL PASO ERIE JOPLIN LOS ANGELES MILWAUKEE MINNEAPOLIS NEW YORK PHILADELPHIA PITTSBURGH PORTLAND RICHMOND SALT LAKE CITY SAN FRANCISCO SEATTLE ST. LOUIS TUCSON BOMBAY BRUSSELS FRASERBURGH HAVANA HONOLULU JOHANNESBURG CHRISTIANIA LONDON MILAN MONTREAL OSAKA PARIS SKIUL SYDNEY TOKYO TORONTO VANCOUVER WINNIPEG

P29

BOYER PNEUMATIC HAMMERS · · · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · · VACUUM PUMPS · · GIANT FUEL-OIL, GAS, GASOLINE AND STEAM ENGINES ROCK DRILLS · · · COAL DRILLS

CHICAGO PNEUMATIC

LITTLE GIANT

Depend upon that Name

Employ a Firm of Engineers To Build Your New Foundry

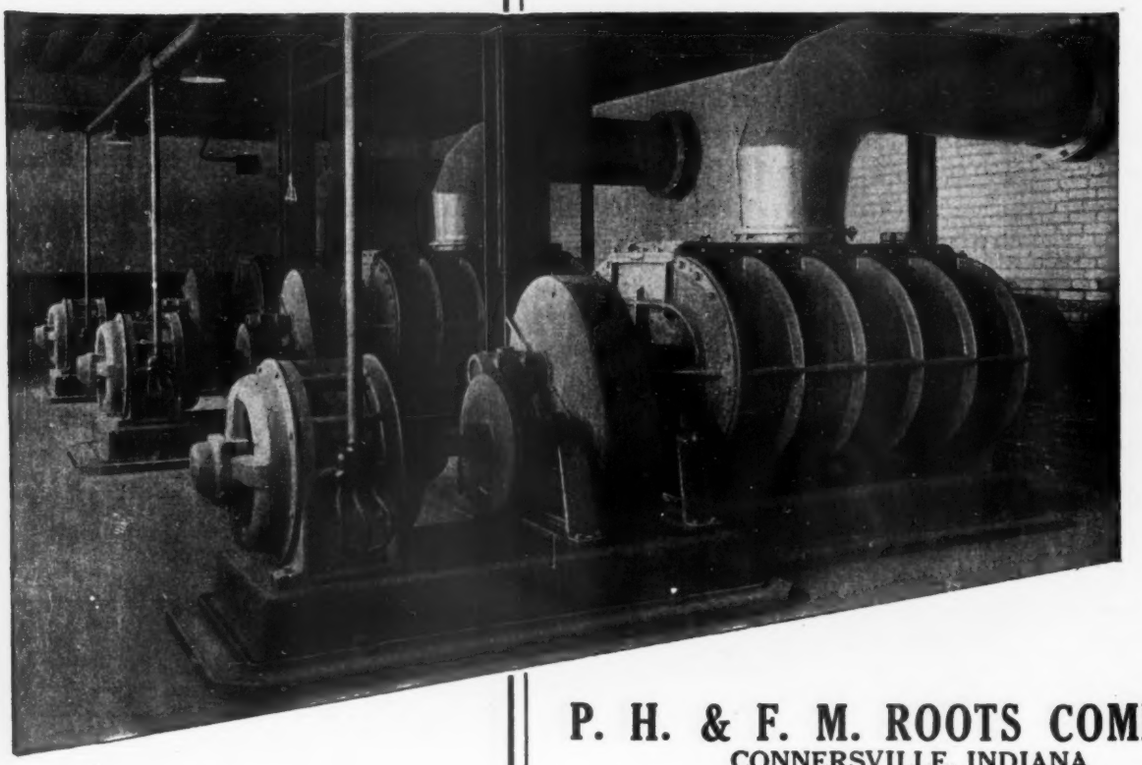
We recommend that, as a matter of economy, you employ a competent firm of engineers to design and build your new foundry, or new addition to your present foundry.

The complete plant produced by the combined knowledge and experience of such an organization of broad-gauge men will be a better solution of your problem than one produced by a single man, no matter how brilliant he may be.

We advise you to allow the engineers to use their judgment in selecting the proper blower for your cupola.

Our experience has been that when competent engineers are allowed to choose the foundry blowers, they invariably buy ROOTS.

A group of Roots Foundry Blowers installed at the new foundry of General Motors Corporation, Saginaw, Mich. Designed, Built, and Equipped by FRANK D. CHASE, Inc., Industrial Engineers, Chicago.



P. H. & F. M. ROOTS COMPANY
CONNERSVILLE, INDIANA

Chicago Office: People's Gas Building
New York Office: 120-122 Liberty Street

NATIONAL FOUNDRY BLOWERS

There is no more efficient blower for foundry work than the two-impeller positive pressure type.

National blowers are the result of twenty-five years' experience and embody improvements in design and manufacture which place them easily at the head of the list for efficiency and durability.

With a National blower there is no guessing as to the volume of air you are delivering to your cupola, or the pressure at which you are delivering it. The National blower can be relied upon to deliver exactly the required quantity of air at the required pressure every minute of its operation.

Made in all sizes.

Write us for information and prices.

Horace G. Cooke, Incorporated

Associated with
NATIONAL MARINE ENGINE WORKS, INCORPORATED
50 East 42nd Street
New York City

SPENCER TURBO-COMPRESSORS

SIMPLE, QUIET, LONG-LIVED

——direct connected, avoid necessity of belts, gears and chains.

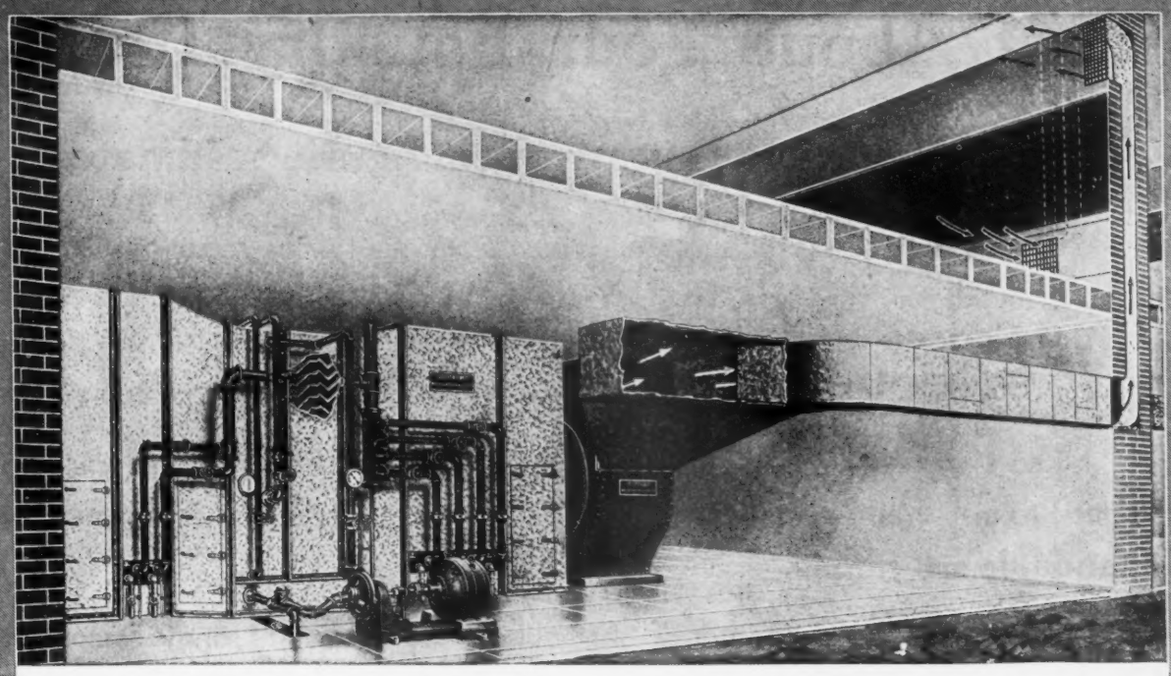
——operate noiselessly; no contacts, pulsations or surgings.

——operate at low speed, retaining their efficiency permanently.

Write for bulletin.

The Spencer Turbine Company
Hartford, Conn.

Motor End No. 1050
Turbo-Compressor



Typical Sturtevant Heating, Ventilating, and Air Conditioning Installation.

Speed Up!

PRODUCTION—PROFITS—HEALTH

Clean, purified foundry air keeps employees healthy and contented. Satisfied workmen are more efficient. They produce more and better work, which yields larger dividends for manufacturers.

Sturtevant
(REG. U.S. PAT. OFF.)

HEATING—VENTILATING—AIR CONDITIONING SYSTEMS

—insure a positive and constant supply of purified air, heated, cooled, humidified, or dehumidified—as required. The ideal manufacturing condition in *any* plant can be reproduced *every* day in the year by Sturtevant systems, which operate irrespective of outside weather conditions. All systems are scientifically designed to the needs of the plant.

The refinements in design, material, and construction of Sturtevant Fans, Heaters, Air Washers, and driving apparatus account for the continuous dependability and operating economy of Sturtevant Heating, Ventilating, and Air Conditioning systems. Request our engineering department to make a study of your plant and submit a plan and an estimate of your requirements. No obligation incurred. For your convenience twenty-three Sales Engineering branches are maintained in the leading business centers. Bulletins of specifications, apparatus, and installations on request.

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASS., AND ALL PRINCIPAL CITIES

Sturtevant
IS AIR TO WORK

What About Your Foundry Costs?

Are you relying upon guesswork in figuring estimates?

Eliminate this risky business of basing your quotations upon "probable" costs and found your figures on fact! You can do this with the aid of

"Foundry Cost Accounting"

The systems outlined in this new book give you **exactly** the information you need to install and operate in your foundry a cost system that is **accurate, dependable** and **simple.**

Robert E. Belt, the author of this book, is cost accountant for the American Malleable Castings Association. In his wide experience he has installed in a large number of successful foundries **exactly** the same systems which are explained with so much detail in "Foundry Cost Accounting".

"Foundry Cost Accounting" is **NOT** a theoretical treatise for the use of highly trained experts. It is an every day book, simply written, easily understood and gives you a common sense idea of knowing at all times just what **every** job and **every** operation in your plant is costing you.

The edition is limited—better place your order now
to make *sure* of getting a copy of this helpful book.

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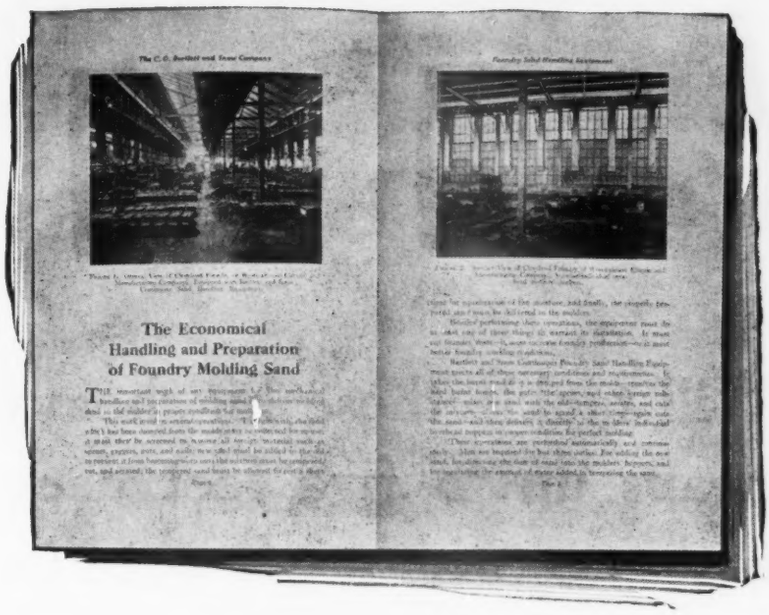

A WORTH WHILE BOOKLET

For Men Who Operate Foundries
And Men Who Plan Foundries

THIS is a worth while bulletin on mechanical equipment for the handling and preparation of molding sand. It will tell you how you can do with fewer men, how you can increase production, and how you can make more satisfied workers. Foundry operators, foundry executives, men who plan foundries, who are interested both in more contented men and in greater and more economical foundry production, can well afford to spend the time to read this bulletin. It carries a message of real worth.

Just ask us for bulletin 4500

THE C. O. BARTLETT & SNOW CO.

MAIN OFFICE AND WORKS: CLEVELAND, OHIO

THE WADSWORTH CRANE TYPE SAND CUTTER

Will tackle those big, heavy heaps up to five feet deep and any width. It cuts its own path six feet wide so that four cuts on a twenty-four foot wide heap leaves the Sand Ready for the Molder.

It handles 2000 cu. yds. of sand per hour.

LET US TELL YOU MORE ABOUT IT

WADSWORTH SAND CUTTER CORPORATION

SLOAN BUILDING CLEVELAND

Good materials and good practice produce good results

Up-to-date methods are not all that is required to place a foundry upon the highest efficiency basis.

Reliable materials with which to work are just as essential, if not more so, as modern foundry equipment.

The core-maker may be equipped with the finest kind of tools, excellent sand and a high grade oven, but unless he has a reliable core compound with which to bind his sand, he cannot produce the best of cores.

It is up to you, Mr. Foundryman, you who expect the ***best results,*** to furnish the ***best materials.***

Woodseed Liquid Core Compound is a binder made from a pure Linseed Oil base which is equal to Linseed in binding strength, bakes faster and costs less. It will produce more satisfactory cores per dollar than pure Linseed Oil.

Don't handicap your core makers—supply them with Woodseed Liquid Core Compound and notice the improvement in their cores.

We will send you a barrel of "Woodseed" on trial to be used under your own conditions. If it does not prove to be just as represented, we are to be immediately notified and will send a representative to assist you in getting the desired results.

Write or wire us your permission today.

THE E. J. WOODISON COMPANY
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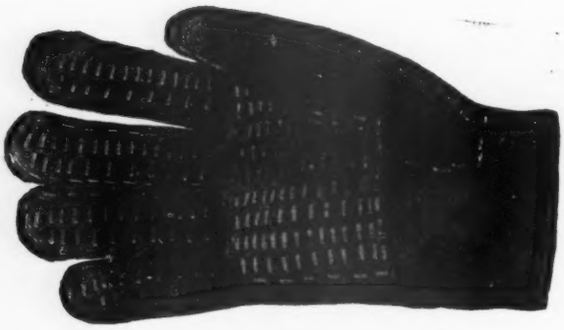
Let Your Workmen Decide

No. 644. GAUNTLET GLOVE

A soft pliable glove re-inforced with steel ribbons over strips of tough leather. Sewed with steel—four inch gauntlet. Three wearing surfaces.

Price - per dozen pairs $16.50



No. 605. SHORT GLOVE

A heavy service, short wrist glove with extra leather patch. Steel sewed and steel re-inforced but flexible and comfortable.

Price - per dozen pairs $12.00

There are several styles of Steel-Grip gloves and so that you may test out to your own satisfaction the style of hand protection that is best for the particular work in your shop or foundry, you may order an assorted dozen Steel-Grip gloves or mittens and let your workmen tell you which to buy.

There is no question regarding the advisability of buying Steel-Grip gloves because they have the maximum hand protection and longest service.

We base our statements on our knowledge of what Steel-Grip gloves are doing in thirty-four lines of industry where rough materials are handled. Nearly every trial order has resulted in making a steady customer.

Many users have been buying Steel-Grip gloves for more than eight years.

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MADE IN CHICAGO

Industrial Gloves Corporation

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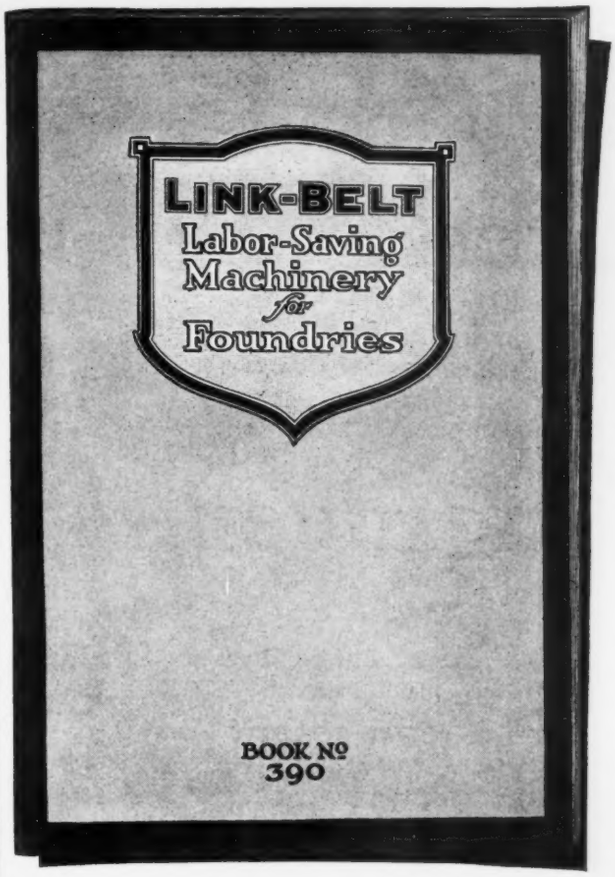


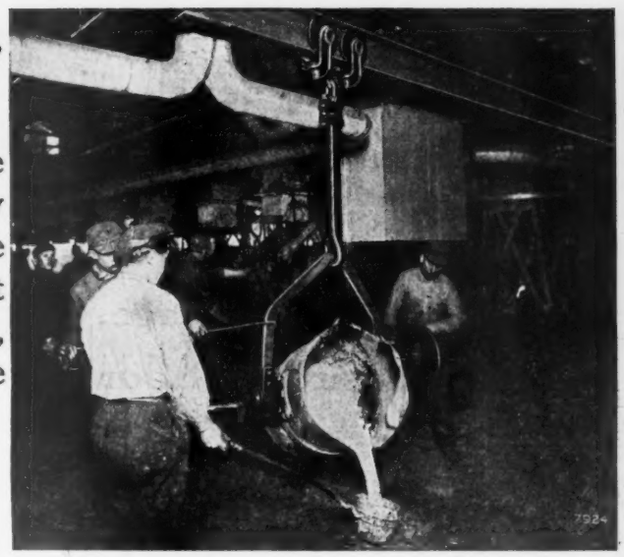
Get This New Link-Belt Labor-Saving Machinery Book

IT illustrates and describes Link-Belt modern, efficient labor-saving elevating and conveying machinery as used in many up-to-date foundries.

It is a book of ideas for those who desire to increase foundry output with the minimum of labor and operating expense.

Every Foundry Manager, Superintendent, and Production Man Should Read It.

Link-Belt engineers have specialized in the design of elevating and conveying machinery for foundries. The book shows some of the results of their work, and illustrates Link-Belt equipment handling sand, pig-iron, coke, molds, castings, refuse—in fact the entire product of the foundry.



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USE THE COUPON.

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You may send us a copy of your book No. 390, "Link-Belt Labor-Saving Machinery for Foundries."

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Wanted

by the manufacturers of Coleman Ovens

A Sales Engineer

Unusual opportunity for a competent Engineer experienced in the furnace and oven field, to become associated with this rapidly growing organization and to develop into a capable assistant to our General Manager, Mr. F. A. Coleman.

State age, experience and salary desired. Address

The Foundry Equipment Co.

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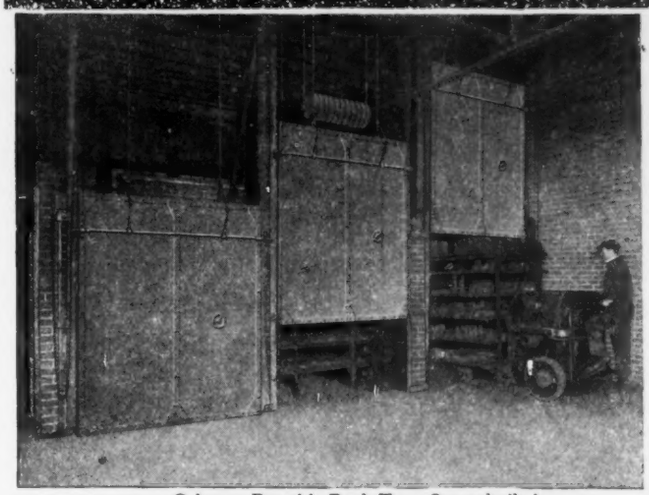
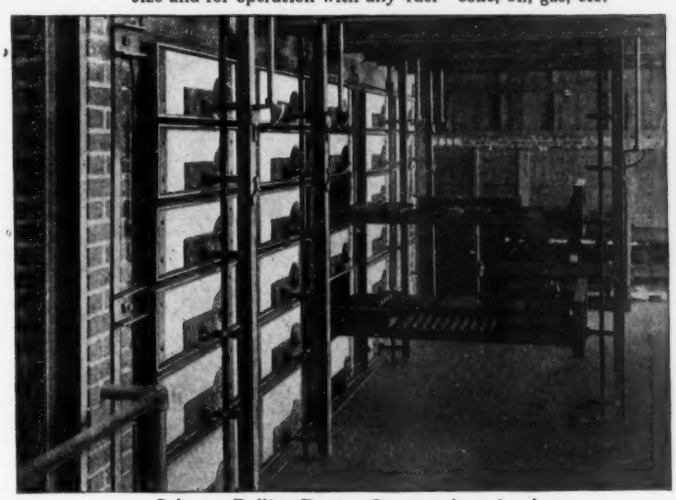
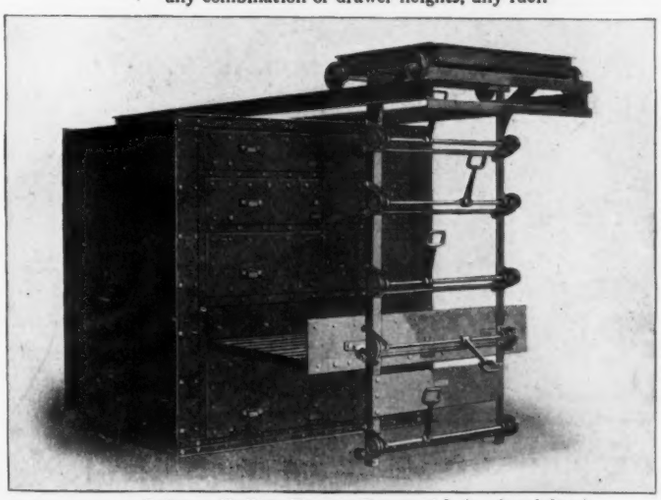


Coleman Portable Rack Type Ovens built in any size and for operation with any fuel—coke, oil, gas, etc.



Coleman Rolling Drawer Ovens. Any size drawers, any combination of drawer heights, any fuel.



Coleman Rolling Drawer Ovens with Insulated Steel Housing. Built in any size. Any fuel.

OVENS

are the result of over 15 years of progressive Core and Mold Oven building.

They save time, space, labor and money because they positively assure

UNIFORM TEMPERATURES

RAPID, EVEN BAKING

ECONOMICAL FUEL CONSUMPTION

LOW MAINTENANCE COST

Coleman Core and Mold Ovens are built in any size, and for operation with any fuel—coke, oil, gas, etc. Let us know your requirements and we shall be glad to submit specifications and proposal.

USERS OF COLEMAN OVENS

include representative foundries everywhere, in every class of foundry work—gray iron, steel, malleable iron, brass, aluminum, etc. May we refer you to users in your locality?

Write today for new Coleman Oven Catalog.

The Foundry Equipment Company

Engineers and Manufacturers

1831 COLUMBUS RD. CLEVELAND, OHIO

Coal Strike
Car Shortage
Stock Piles—

While the coal strike and car shortage has hit us all we have been keeping our customers' wants in mind and have utilized the time in accumulating STOCK PILES of our dependable SANDS. These piles are built solely for the benefit of our customers who may need SAND during the winter months when the pits are frozen and it is impossible to load.

We are ready to furnish YOU with stock shipments of highly refractory, good bond, good color NASH, No. 1 and 1½ CONNEAUT SANDS for light and medium Castings.

Gordon Sands are highly refractory, produce fine surfaced castings, bond well and vent freely. They are especially adapted for Gray Iron, Malleable, Aluminum and Brass Molding.

Write for quotations and samples.

GORDON SANDS

Banks at
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THE GORDON SAND CO.

Owners and Operators of
THE OHIO SAND COMPANY
Miners and Shippers of all grades of Molding Sands
CONNEAUT, OHIO

F. E. GORDON, Pres. Established 1879

Internationalizing the Penton Publications

Internationalizing the

H. Cole Estep

REALIZING keenly that the war has brought about changed conditions in American industry and that the possibilities of foreign business are receiving the thought and attention of American manufacturers as never before, it has seemed to us to be in line with our responsibility as publishers of *The Iron Trade Review*, *Daily Iron Trade and Metal Market Report*, *The Foundry*, *The Marine Review* and *Power Boating*, to enlarge their scope and service to meet these new conditions.

Accordingly, we are undertaking to internationalize the Penton publications as rapidly and effectively as possible. Although for years possessed of a superior foreign news representation through resident correspondents, these facilities will be notably expanded and their operation brought under the management of a special European division of *The Penton Publishing Company*, which has been created, with headquarters in London, and from which will be directed the editorial and business activities covering Great Britian and Continental Europe. Commodious and specially equipped offices have been opened at Dorland House, 16 Regent St., S. W. 1, London.

H. Cole Estep, manager of the European division, has been prominently identified with the staff of this company since 1908. His experience has included many years of study and of close contact with both the commercial and technical branches of the American iron, steel, metalmaking and marine industries. A graduate engineer, and student of the marine field, he is especially fitted to present and interpret the development of European production and manufacturing practice in the reconstruction period. Mr. Estep, who has recently been editorial director of *The Penton Publishing Company*, will devote his sole attention to foreign development, and will make his residence in London.

Joseph Horton of Birmingham, England, remains as British correspondent, a post he has capably filled for many years. Mr. Horton's iron and steel market reports and special articles have been accepted

Penton Publications

as authority and long have been a prominent feature of these papers.

JOSEPH HORTON

Francis Miltoun Mansfield, whose numerous articles on French, Belgian, Italian and German industrial conditions appearing in *The Iron Trade Review* for several years past under the name of Francis Miltoun, have attracted wide and favorable attention, will continue as French editorial representative. Mr. Mansfield is an American and his long residence in Paris has given him a peculiar equipment and experience for assembling information regarding French industrial conditions and of analyzing it from the American viewpoint.

Various additions to the European editorial staff are to be made from resident correspondents in Great Britian and on the Continent, so that the activities of every great industrial country and section will be brought continuously, completely and comprehensively before the readers of the Penton publications.

In order to promote more quickly and readily the business and editorial relations between the various Penton papers and their readers and advertisers abroad, The Dorland Agency, Dorland House, 16 Regent St., London, has been appointed general British Advertising Agents for *The Penton Publishing Company.*

FRANCIS MILTOUN MANSFIELD

The additional service which this expansion will give foreign as well as domestic readers of these papers, to say nothing of the increased circulation of each, which is already noticeable, has corresponding value for the wide-awake American and European manufacturer, who appreciates the possibilities of foreign trade. This service is now at their disposal.

The Big Five

THE IRON TRADE REVIEW

Thoroughly covers the field of iron and steel making, metal working, etc., from the mines through the furnaces, mills and finishing plants.
THE IRON TRADE REVIEW is read by the executives of these plants and its circulation of 12,000 is international and of the highest quality. Established 1883; published weekly, $5.00 per year; type page 7 x 10; average number of advertising pages, 190; yearly page rate, $60.

DAILY IRON TRADE and METAL MARKET REPORT

A daily newspaper for buyers and sellers of iron, steel and non-ferrous metals, iron ore, coal and coke. Twelve page, standard newspaper size, published every business day, except Saturday; $12 per year. The DAILY has a national circulation and is depended upon by the largest producers and buyers as the most complete and authentic source of daily market and trade information. Established 1909; circulation 5000; type page 15¾ inches x 20½, seven columns to the page; advertising rates, 1500 or more inches, yearly contract, 55c per inch.

THE FOUNDRY

A technical journal covering every branch of foundry practice, including iron, steel, brass, aluminum, and copper plating. Its circulation of 12,000 is world-wide among a high class of readers who are responsible for the buying of every kind of machinery, equipment and supplies, used by every modern foundry in the United States and Canada, and to a large extent, abroad. Established 1892; published semi-monthly; $2 a year; type page, 7 x 10; average number of advertising pages, 143; yearly page rate, $65.

POWER BOATING

A class publication covering the field nationally. Devotes special departments to Cruising Problems; The Commercial Power Boat; Talks with the Dealer; Club News; Questions and Answers relating to equipment and operation of power boats.
POWER BOATING was the first paper to take up the power workboat in a big way and is devoting more and more space to this new and rapidly growing field. Established 1905; published monthly, $1 a year; circulation 10,000; type page, 7 x 10; yearly page rate, $75.

THE MARINE REVIEW

Serves the entire field, not only the Atlantic and Pacific Coasts but the Great Lakes, Gulf, and other inland waterways as well. Edited for and read by the executives among the shipbuilders, ship owners, and ship operators, it offers the most effective means of keeping prominently before the men who today are laying the foundation of the real American Merchant Marine. Established 1878; published monthly, $2 per year; circulation 5500; type page, 7 x 10; average number of advertising pages, 116; yearly page rate, $60.

The Penton Publishing Co

PENTON BUILDING CLEVELAND, U. S. A.

ALSO PUBLISHERS

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They Certainly Make Good!

PORTAGE SANDS

You can bet your last bloomin' dollar, sir, that I wouldn't uv been through with them castings for a couple a hours yet, if I hadn't a used *Portage Sand Blast Sand*—nor would the boss uv looked 'em over good 'n' said, "You're there, boy." 'N' if you think I'm kiddin' ya, sir, just come around some day and see—or else send for a trial order of *Portage Sand Blast Sand* 'n' have your own man go to it in your own plant on your own castings.

And it's none of my business, I know sir, but if you're not usin' *Portage Steel Molding Sand* out on your floor—take a good red hot tip from me sir, and give it a trial.

Over 98% Silica

Start your castings right with *Portage Steel Molding Sand*—and *finish* them right with *Portage Sand Blast Sands*

The Portage Silica Company

YOUNGSTOWN, OHIO

FLINT
Steel Molding Sand
SILICA

HAS REMARKABLE
REFRACTORY PROPERTIES

FLINT SILICA molding sand is a wonder worker in steel foundry practice and for electric steel foundries it is a "veritable life-saver" because it alone seems to be able to withstand the extremely high pouring temperature of electric steel, without fluxing or burning fast to the castings.

Its resistance to high temperatures is due to two things:

First—The chemical purity and physical properties of the Silica itself.

Second—Its entire freedom from all fluxing impurities. This we accomplish by systematic washing and rinsing operations, followed by drying and screening.

Electric Steel practice is the hardest test any molding sand can be put to; and the fact that Flint Silica is now used exclusively by many leading Electric Steel Companies, is all the recommendation that makers of other forms of steel castings can ask for.

Try one carlot. Its performance will make you an enthusiastic convert and regular customer.

United States Silica Company

Sole Producers of Flint Silica

1958 Peoples Gas Building
Chicago

SIMPSON INTENSIVE FOUNDRY MIXER

Economical and efficient for all kinds of Sand Mixtures

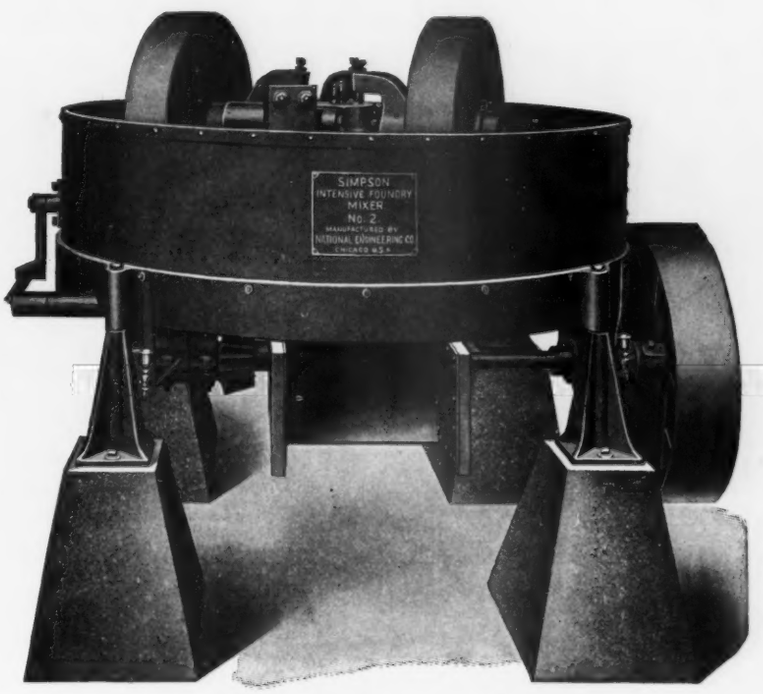
Note the AUTOMATIC DISCHARGE

It saves LABOR BINDER and NEW SAND

It improves the quality of the castings

Its work is done thoroughly not partially

Elasticity and toughness of sand are enormously increased



"The Product of a Practical Foundryman"

Thoroughly amalgamates the mixture

Small H. P. required with a minimum of repairs

Pays for itself in an incredibly short time

Original porosity of sand mixture maintained

Large capacity with a minimum of labor

Will reclaim old and worn out sand for reuse

¶ The large number of Simpson Mixers in use all over this country testifies to its efficiency. Send for our pamphlet No. 25 and list of users.

Write us regarding your sand mixing problems. We are specialists in this important department of a foundry

Simpson Mixer made in three sizes

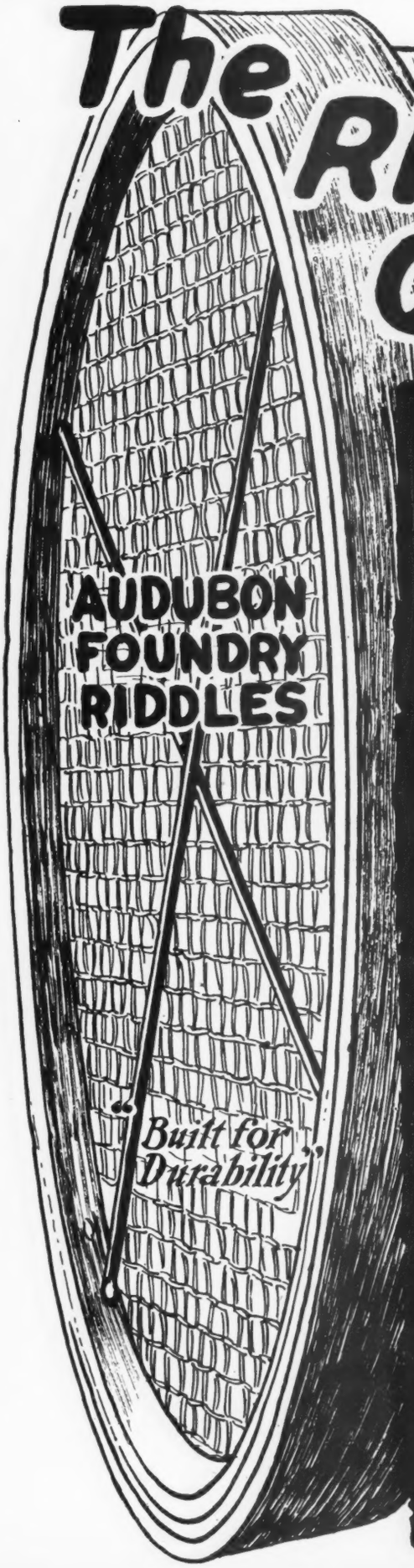
No. 0—3 ft. diameter, No. 1—4 ft. diameter
No. 2—6 ft. diameter pan

NATIONAL ENGINEERING COMPANY

Machinery Hall Bldg., 549 W. Washington Blvd.

CHICAGO, ILL.

The RIDDLE QUESTION



Have you been getting uncertain results from your riddles?

Then remember this:

The life of a riddle depends upon the gauge of wire used, the thickness and composition of the rims and the method of fastening the wire.

Audubon Riddles are built for

durability.

Heavy gauge galvanized cloth and extra thick elm rims are used in their construction so as to insure extra strength.

The method used in fastening the cloth in Audubon Riddles prevents sagging or pulling out of the cloth from the rims.

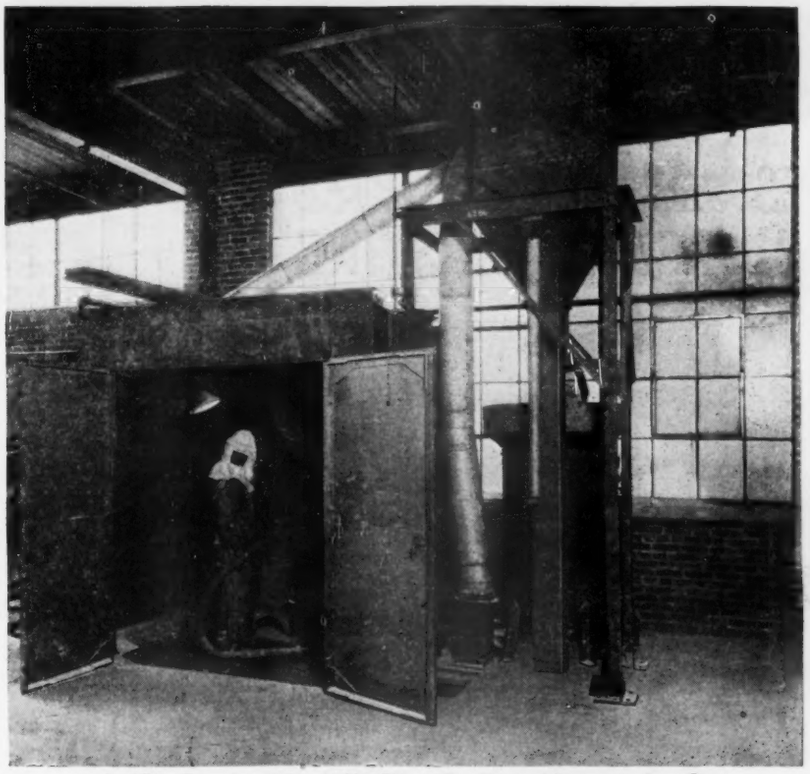
When you are in the market again for riddles, specify **Audubon Riddles**—if you would have long **lasting** riddles.

If your jobber does not handle them, write to us direct.

AUDUBON WIRE CLOTH CO., Inc.

AUDUBON, NEW JERSEY

SLY FOUNDRY EQUIPMENT "UP - TO - DATE"



Sand Blast Room Installed in the New Plant of The Cleveland Cooperative Stove Co.

Men Clean More Castings in Less Time in a SLY Sand Blast Room

Time consumed in waiting for dust to settle is turned to greater production.

The down draft ventilation of a Sly Sand Blast Room keeps the dust from obstructing the operator's view.

A double ceiling insures even distribution of air which by carefully proportioned openings is changed by uniform flow from ceiling to floor at least seven times a minute. This action of the air carries the dust down into the hopper—takes the terror out of working in a sand blast room and conforms with the factory laws of the different states.

There's no ledges where dust can collect in Sly Sand Blast Room. Installed in any number of units required. Economical in up-keep, simple in operation, Sly Sand Blast Rooms are in the largest industrial plants in the country.

Your cleaning problem is almost certain to be similar to one of the hundreds solved by Sly Engineers. Give us the details and you shall have practical suggestions that will solve your problem.

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Sand Blast Rotary Tables
Sand Blast Mills
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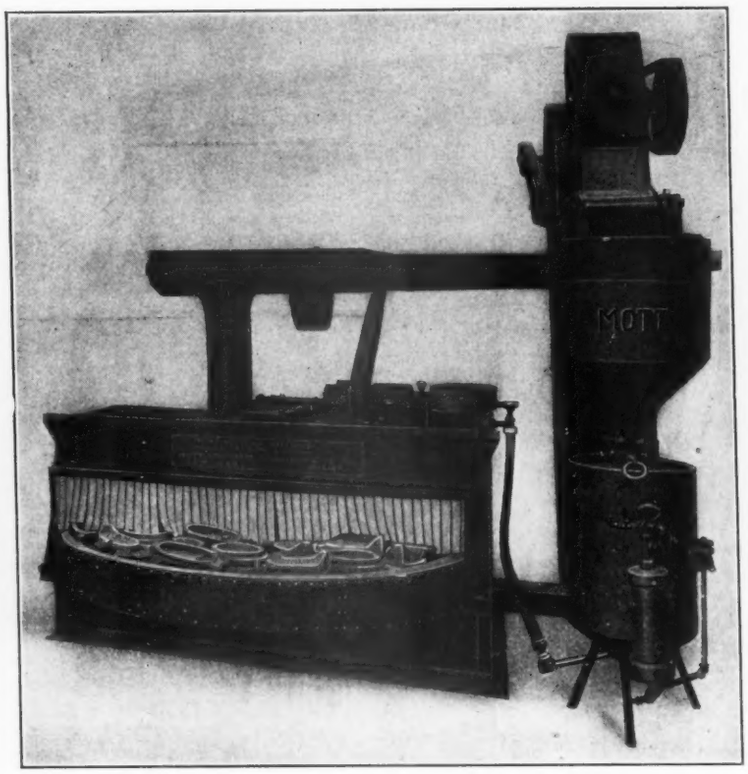
MOTT

SAND BLAST EQUIPMENT

MACHINES and ACCESSORIES for all kinds of SAND BLASTING

Mott Sand Blast Helmet



Mott Rotating Table Machine
Direct Pressure Blast. Type P. E. S.

Complete Sand Blast Plants

Cleaning Rooms

Hose Machines

Sand-Blast Barrels

Revolving Sand-Blast Tables

Sliding Sand-Blast Tables

Cabinets, Hoods, Gloves, Hose, Respirators, Nozzles, Abrasives, etc.

We maintain an engineering force at all times that can be placed at your service to assist you in planning or laying out your installation.

Our engineers have designed some of the largest and most efficient installations in the country. Send us your blue prints.

MOTT SAND BLAST MFG. COMPANY, Inc.

EVERYTHING IN SAND BLAST

NEW YORK
Frost St., Brooklyn, N. Y.

DESIGNS FURNISHED

CHICAGO
24-30 South Clinton St.

Morse

RAREFIED DUST COLLECTOR

DUST in the foundry acts injuriously upon foundry workers thru irritation of the delicate membranes which line the respiratory organs. The minute, hard, sharp, angular particles of dust which arise from sand blasting, rumbling, chipping, core-busting and cinder milling are with difficulty coughed or spit out. The result is that the throat and lungs of these workers, thru constant irritation, become breeding places for colds, influenza, pneumonia and tuberculosis.

You owe it to your employees to provide a means of eliminating this dust peril in your foundry.

You, yourself, will be the chief benefactor from the installation of a *Morse "Rarefied" Dust Collector,* for while bettering conditions under which your employees work you are increasing the efficiency of your employees as well as production of your foundry.

There is no other device used in connection with an exhaust system, which separates the dust with the degree of consistency and reliability as does the *Morse Rarefied Dust Collector.* Let us send you our Catalog and list of installations.

THE KNICKERBOCKER CO

516 LIBERTY STREET-JACKSON MICHIGAN

Bakelite Micarta

Gears and Pinions

Reduce Maintenance Costs

Bakelite Micarta Gears effect the minimum of wear on the mating gear and have a longer life than any other non-metallic gear. They are comparatively noiseless and in many cases will outwear both cast iron and brass.

These gears will not shrink, swell nor warp and are unaffected by oil.

Bakelite Micarta Gears and Pinions have proved their efficiency and service-giving qualities in practically every industry.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

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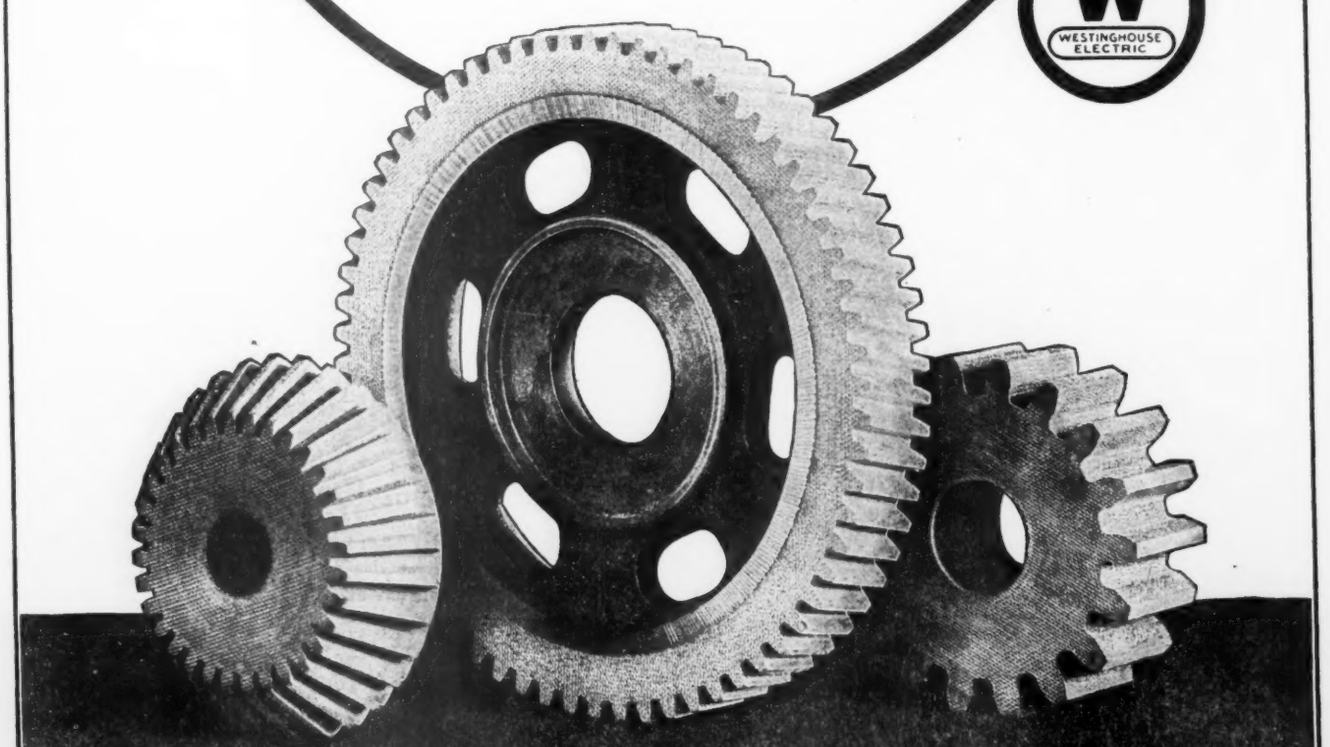
Newark, N. J., Newark Gear & Mch. Co.
Philadelphia, Pa., Rodney Davis.
Philadelphia, Pa., Earle Gear & Mch. Co.
Philadelphia, Pa., Philadelphia Gear Works.
Pittsburgh, Pa., R. D. Nuttall Co.
Pittsburgh, Pittsburgh Gear & Mch. Co.
Pittsburgh, Pa., The Simonds Mfg. Co.
St. Louis, Mo., Turley Gear & Mch. Co.
San Francisco, Pacific Tool & Gear Works
Syracuse, N. Y., Weeks-Hoffman Co.
Worcester, Mass., Beacon Gear Shop.
Woburn, Mass., Woburn Gear Works.

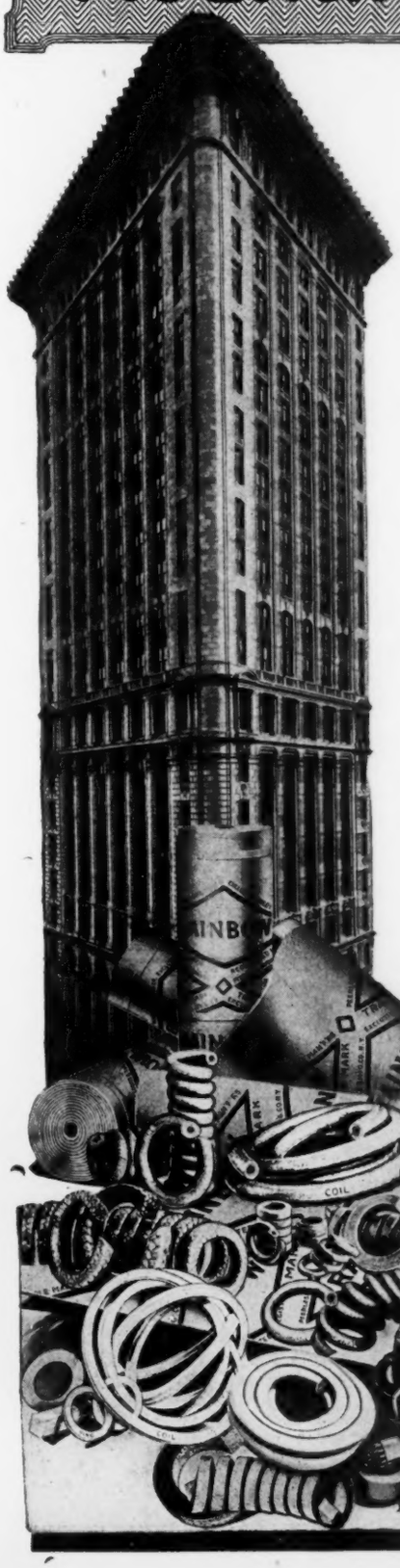
W
WESTINGHOUSE ELECTRIC



Westinghouse

US
UNITED STATES RUBBER COMPANY
AND ASSOCIATED COMPANIES
RUBBER SYSTEM

Mechanical Rubber Goods



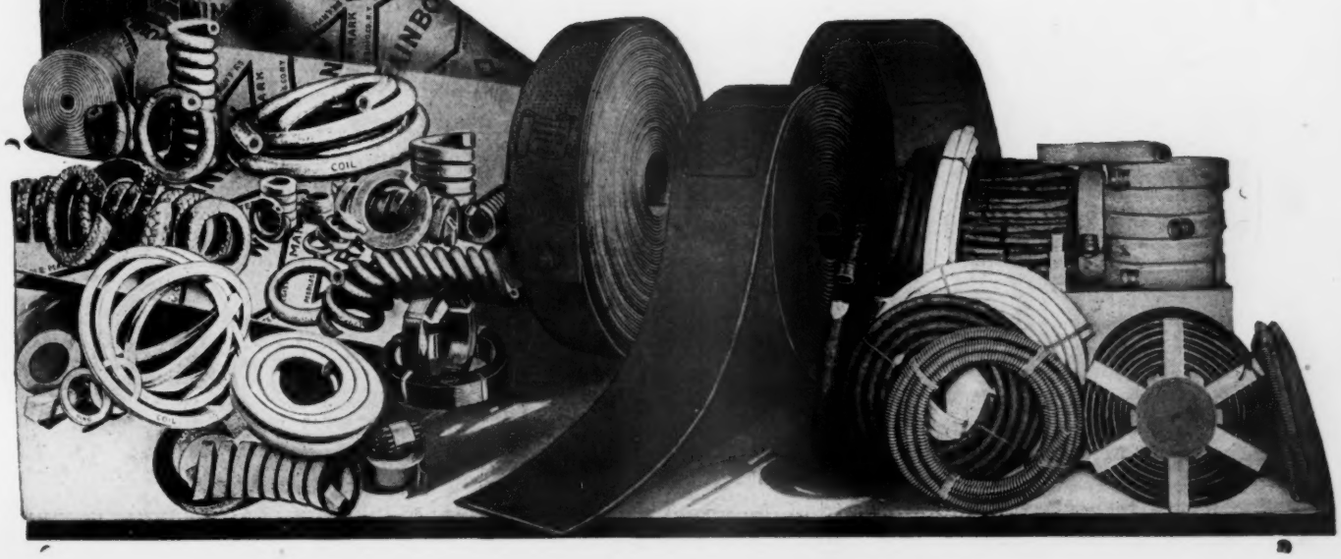
TO meet the tremendous demands of industry, the United States Rubber Company produces a line of mechanical rubber goods complete in every detail and manufactured with due consideration of the conditions of service to be encountered by each product.

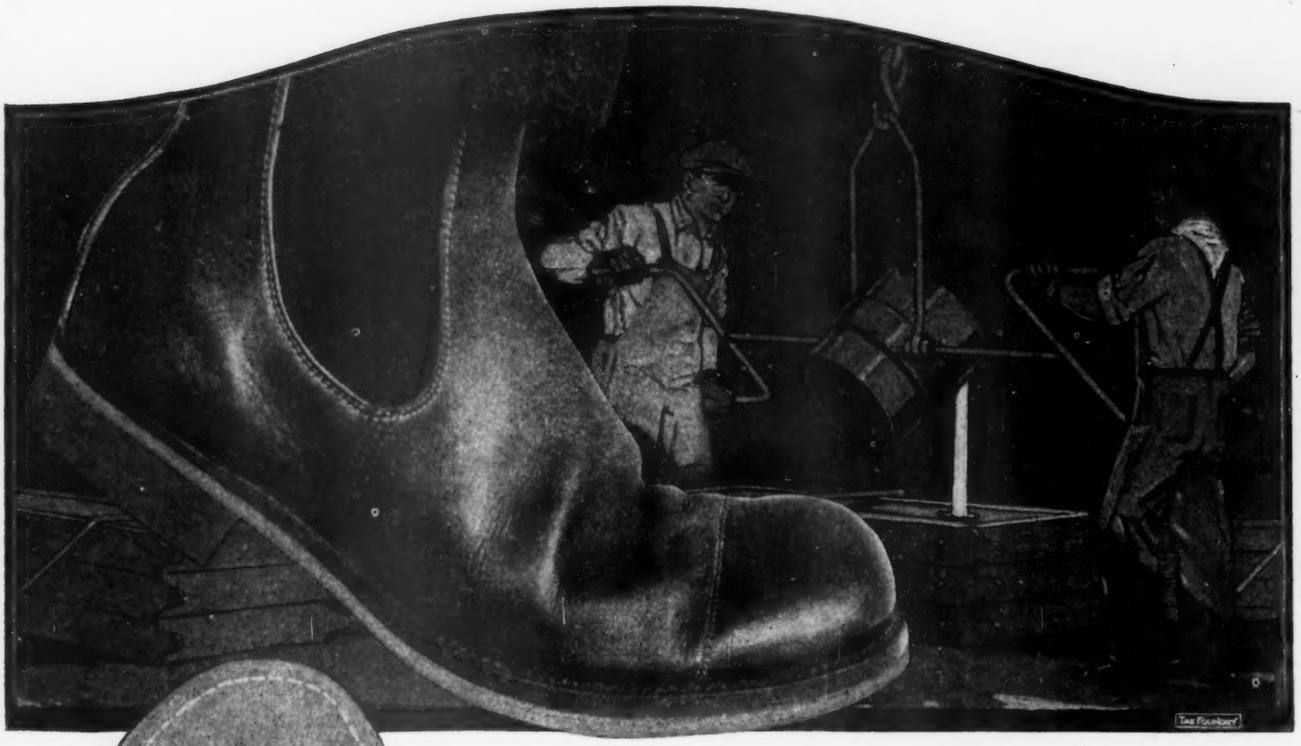
Wherever there exists an engineering problem involving the proper application of these mechanical rubber goods, the advice of United States Rubber Company engineers is available.

This service, based upon long manufacturing experience and the quality of our products, enables operators everywhere to obtain the greatest possible efficiency through using "the right rubber product in the right place."

The United States Rubber Company Building, at Broadway and 58th Street, New York, is a monument dedicated to service in rubber goods.

United States Rubber Company





No. 523
Safety First Molders Shoe

Safety First MOLDERS SHOES

guarantee protection for the molder's feet for many reasons: they are made *right;* they are made of the best materials for the purpose; they are not awkward; and another thing of great importance—they are not handled through dealers to lie around on shelves for months or years deteriorating. Every Safety First Molders Shoe comes to you fresh and full of life, ready to give good, long, hard service. These, then, are the reasons why Safety First Molders Shoes protect *you* by protecting your men.

Furthermore, Safety First Molders Shoes have Neolin Soles and Wingfoot Rubber Heels. Neolin Soles will outlast the best leather sole, and we guarantee to replace any Neolin Sole that does not give entire satisfaction.

Why don't you interest your molders?

Let us send you a trial order.

Safety First Shoe Co.

OF MASSACHUSETTS

General Sales Office **Providence, R. I.**

LINCOLN ARC WELDER

Simple and Economical

The Lincoln Arc Welder is not only the *simplest* welding equipment for the foundry. It is also the *most economical.*

The operator is not delayed by his arc sputtering or going out, because the large stabilizer of the Lincoln Arc Welder automatically enables the arc to meet the constantly varying conditions of work, just as the governor of an engine regulates its speed. With the steady powerful heat of the Lincoln Arc Welder he can work *20% faster than with any other arc welder made.*

Many arc welding equipments are compelled to use "ballast resistances" to steady the arc. By eliminating these, *the Lincoln Arc Welder saves from 40% to 80% of the power costs.*

Yet there is nothing about the Lincoln Arc Welder that your maintenance man "can't understand." It is just as simple as one of the motors around the plant.

One of the Lincoln Arc Welders at the Duquesne Steel Foundry, Pittsburgh.

Bulletin 104-F tells you all about the simple economical Lincoln Arc Welder

---

THE LINCOLN ELECTRIC CO.

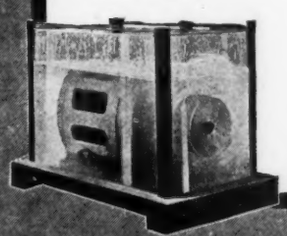
CLEVELAND, O.

New York City	Cincinnati	Columbus	Boston
Buffalo	Chicago	Pittsburgh	Charlotte, N. C.
Syracuse	Detroit	Philadelphia	Minneapolis
	Baltimore	San Francisco	

The Lincoln Electric Co. of Canada, Ltd., Toronto-Montreal

Agencies in other principal cities

This Standard Lincoln Motor operated under water over three years without damage.



What is Reputation?

There is reputation, and reputation; you probably remember W. Shakespeare's reference to the man who "seeks the bubble reputation at the cannon's mouth." That kind of reputation is alright for those who are fond of bubbles; but it is not negotiable and cannot be used to stand off the butcher, the baker and the candlestick maker. As a collateral for a checking account it is about as much use as a last year's straw hat.

The man who runs a foundry may also acquire a reputation. It lies entirely in his own hands whether that reputation lands him in the poor house or whether it carries him on to fame and fortune. The parting of the ways comes when he decides *to* use or *not* to use CHARCOAL IRON.

It does not take many bad castings to shake a customers confidence and send him elsewhere for his work. Hidden defects, cavities or weak spots which only show up when the casting is put in service give the customer the impression that the foundryman is trying to put one over on him and he kicks. This humiliating experience is never forced on the man who uses OUR CHARCOAL IRON in his mixture. He knows that his castings will stand up to any test to which cast iron is subject and that each piece he sends out will serve as an advertisement and as a salesman. Men who have a real reputation and who wish to capitalize it take no chances by using inferior iron—they MAKE THEIR SELECTIONS FROM THE BIG FOUR.

Hinkle Champion Michigan Pine Lake

OUR CHARCOAL IRON

CHARCOAL IRON COMPANY OF AMERICA
DETROIT, U. S. A.

OUR CHARCOAL IRON

How Hot Is Your Brass?

The answer to that question means a whole lot to you, doesn't it? If the temperature is wrong it generally costs *you* some money. If it's not hot enough you get "Cold Shots," and if it is too hot, "Spongy" castings are the result. A temperature too high not only wastes fuel but also wastes metal.

Photo thru the courtesy of the Aluminum Castings Co.

HOSKINS PYROMETERS

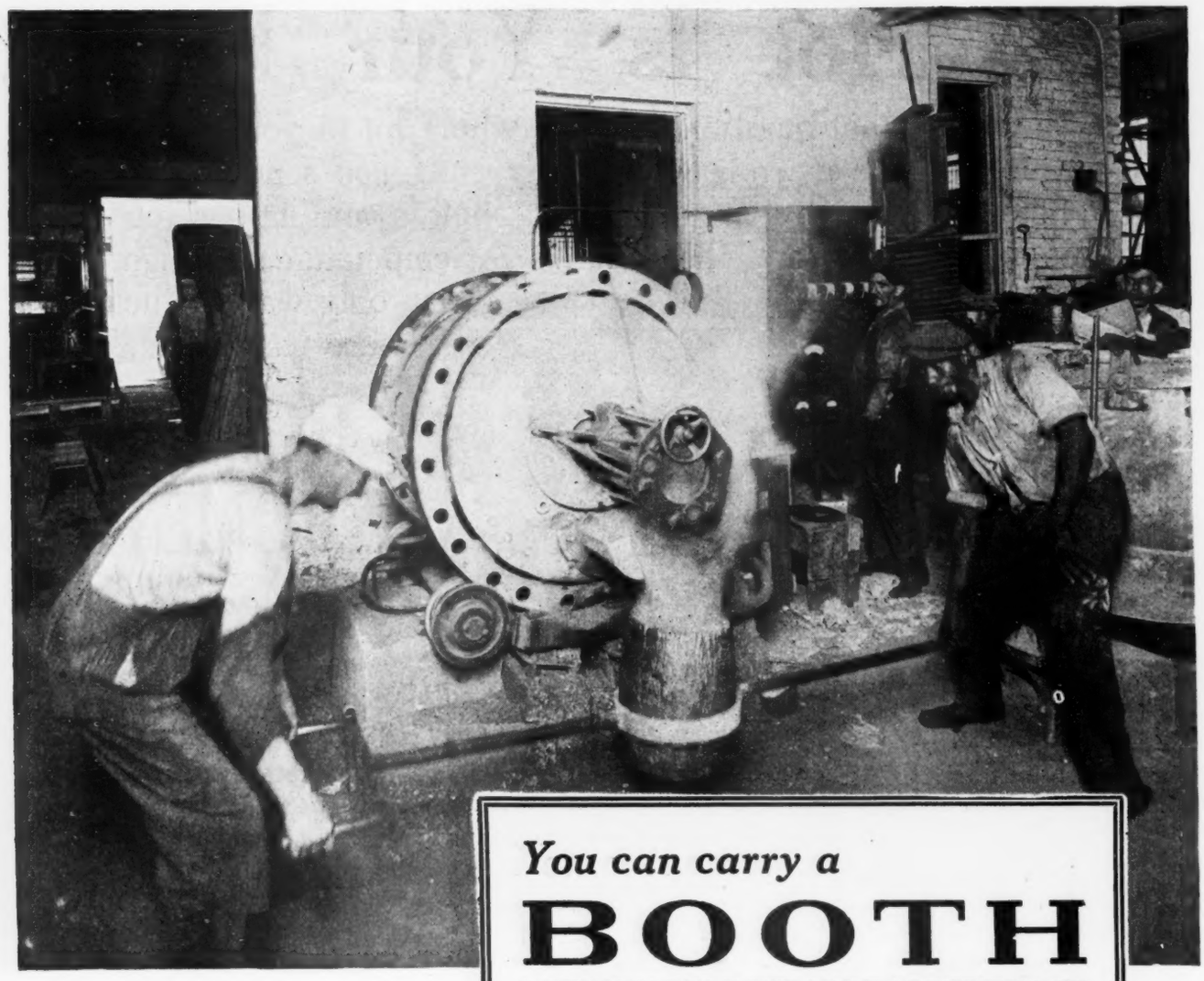
for brass and bronze will help you be sure of your pouring temperatures. Your Foundry Superintendent can estimate temperatures closely with his eye, but the use of a Hoskins Pyrometer will be a big help, both to you and to him. The instrument shown here has just been developed, and is selling fast among the brass foundries, large and small. Its use means fewer defective castings.

It pays for itself in a few weeks—sometimes in a few days. A man told us the other day that it had solved one of his "biggest problems." It may help solve some of yours, too.

Send for Folder 3-F

HOSKINS MANUFACTURING CO.
DETROIT, MICH. U.S.A.

DETROIT BOSTON CHICAGO PITTSBURGH NEW YORK



You can carry a

BOOTH

ROTATING ELECTRIC BRASS FURNACE

with a crane to the mold, and pour direct.

In pouring the *Booth Electric Rotating Brass Furnace*, the tap is opened without coming in contact with the metal, and as the furnace is rotated by the motor, the metal pours out and can either be collected in ladles or can be poured directly into molds by lifting the furnace up off its rollers with the aid of a crane.

Some of the many advantages gained thru rotation, which is the chief feature of the *Booth Furnace*, are: *even wear of linings, greater absorption of heat, lower power consumption, uniform mixing of charge.*

The *Booth Furnace* can be operated upon ordinary 110-volt, single phase service.

Built in 250, 500, 1000, 2000 and 3000 pound capacities.

We have prepared a complete illustrated and descriptive catalog showing *Booth Electric Rotating Furnaces* in actual operation. We would like to place one in your hands.

Makes a heat in 40 minutes to an hour

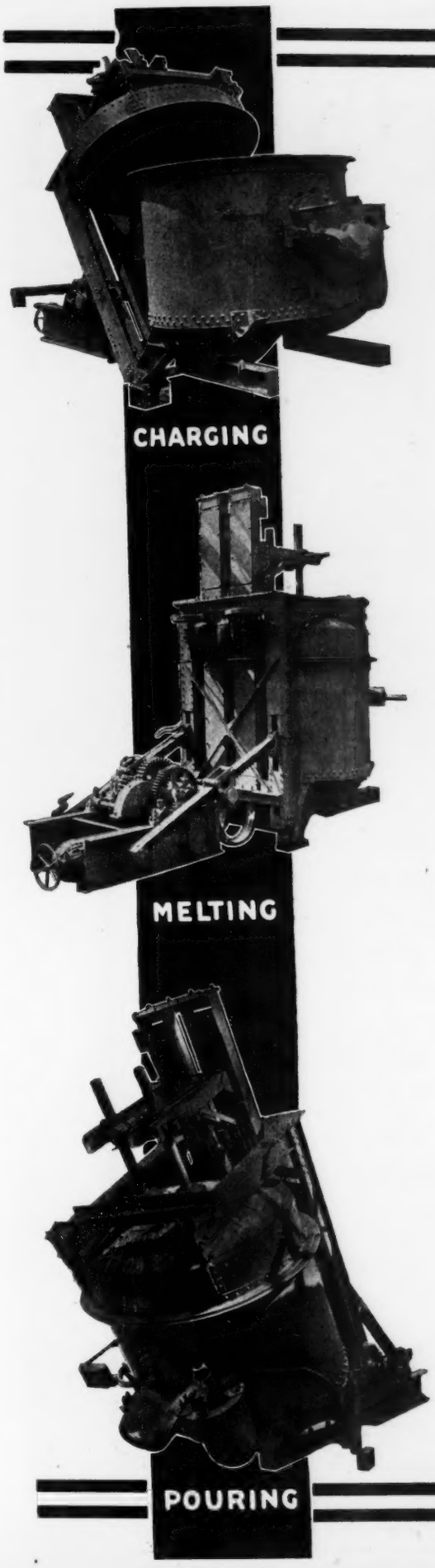
The Booth Electric Furnace Co.

314 S. Dearborn St. Chicago, Ill.

EDWARD B. STOTT & CO.
Flatiron Bldg., New York City

NORTHERN ENGINEERING CO.
308 Chestnut St., Philadelphia, Pa.

Kindly address inquiry to nearest District Office



New Rocking Type Industrial Electric Furnaces

The method of charging this furnace through the opened top makes possible the handling of bulky scrap, cold or preheated metal without difficulty. Efficient operation is obtained by completely filling the furnace.

Melting capacity is increased by the use of the oval shape furnace which allows ample distance between electrodes and between arcs and side walls. These furnaces have large bath area and are shallow. Lining maintenance is a minimum.

The furnace is tilted to pouring position by a neat, compact and substantial mechanism located behind the furnace and below the floor level, mounted on a structural steel frame. Limitation switches make the control automatic.

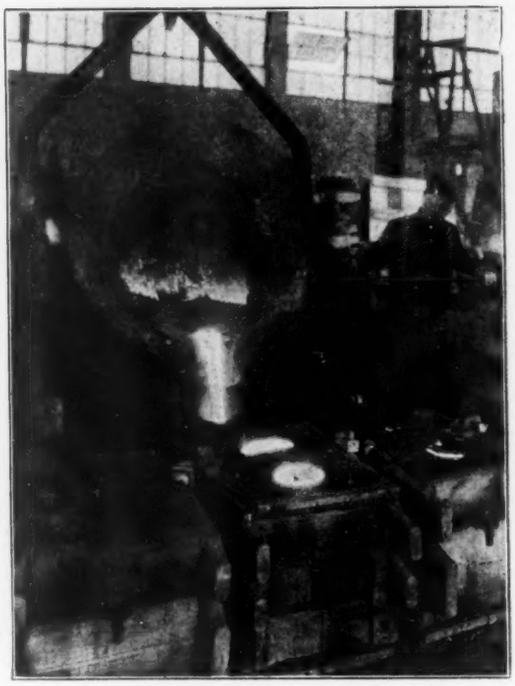
Electrical connections are placed underneath the platform of the furnace. Electrodes are so arranged that an entire heat of the most bulky scrap can be melted without adjustment.

These rocking type furnaces are built in two, four and seven ton capacities, two or three phase, two-electrode, two-arc system, oval shaped type with basic or acid lining.

Write for special supplement "B" to Bulletin 40, giving complete details of this furnace and of the Industrial Electric Furnace production-raising system of preheating.

INDUSTRIAL ELECTRIC FURNACE CO.
53 W. Jackson Blvd.
CHICAGO

Specification Steel—



As the days of priority orders, government requirements and requisitions fade into the past, steel users will become more and more particular regarding the analysis of the product of your foundry.

Steel of lower sulphur and lower phosphorus content will surely be demanded. Particular specifications both physical and chemical will gradually increase as time goes on.

You can meet the demands of the most precise buyer with a *Pittsburgh Electric Furnace* installation.

The *Pittsburgh Electric Furnace* produces deoxidized and denitrogenized steel giving the most desired physical properties to your product. It provides the cleanest and most certain method of melting. It produces rapid heats of a size which is most convenient. It is economical as well as efficient. It is accurately and easily controlled.

Equip your plant or foundry to produce *specification steel.*

Write today for bulletins.

PITTSBURGH FURNACE COMPANY

ELECTRIC ARC FURNACES

MILWAUKEE

CONVERTER STEEL IS
BESSEMERIZED PIG IRON AND STEEL SCRAP

SEMI-STEEL IS
McLAINIZED PIG IRON AND STEEL SCRAP

If you **MAKE—BUY—** or **SELL** gray iron or steel castings, you should know more about **McLAIN'S SEMI-STEEL,** which is a revelation in cupola metals to all who make castings or use them.

McLAIN'S SYSTEM is the science of the foundry and the key to foundry profits today. There is a profit to be made in every foundry—do you get yours? You have bought material and labor for years—now buy the best information on how to use both.

START THE NEW YEAR RIGHT—by presenting your foreman and assistants with **McLAIN'S SYSTEM,** and we will guarantee that you will curtail the frightful waste of coal—coke—and pig iron in your foundry.

McLAIN'S SYSTEM has been accepted as **"STANDARD"** in up-to-date foundries thruout the world. Nothing you can buy will save as much money and as many castings.

Literature upon request.

RETURN COUPON TODAY

McLAIN'S SYSTEM, INC., 803 Goldsmith Bldg., Milwaukee, Wis.
Send information on: Gray Iron and Semi-Steel [] Steel Foundry Practice []
Name.....
Address.....
Firm.....
Position.....
12/15

McLain's System, Inc.
803 Goldsmith Bldg. Milwaukee, Wis.

McLAIN'S SYSTEM WISHES YOU THE COMPLIMENTS OF THE SEASON

QUEEN'S RUN FIRE-BRICK

Since its organization in 1836, this company has achieved and maintained a reputation for making fire brick of quality that is unsurpassed.

Made of clay from our mines in the heart of the district most celebrated for its fire clay deposits. Queen's Run Fire Brick have an extraordinary quality of heat resistance and give maximum satisfaction.

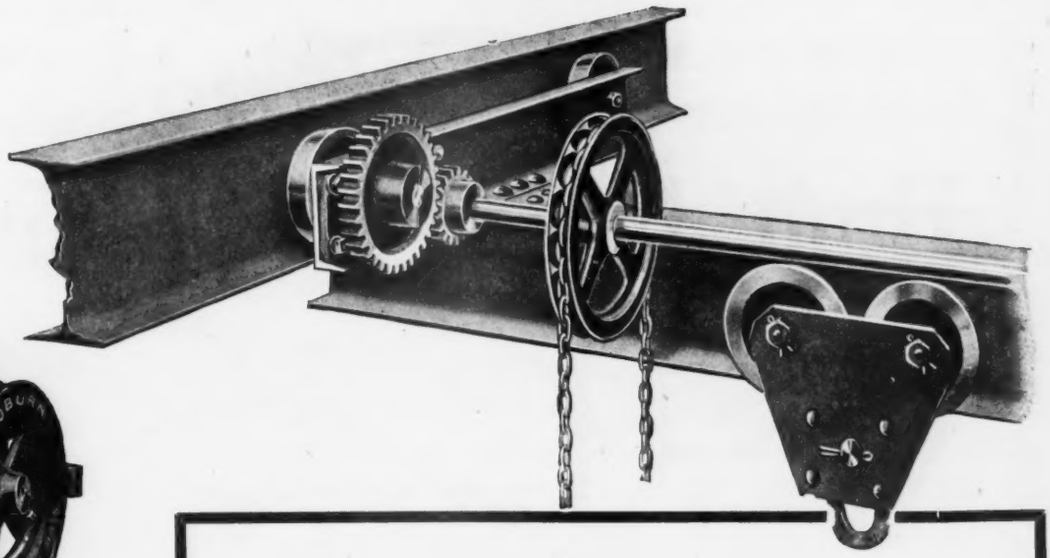
Write today for detailed information. The advice of our engineering department is freely given.

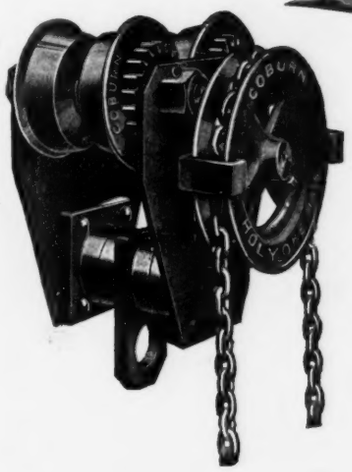
DEPT. FY

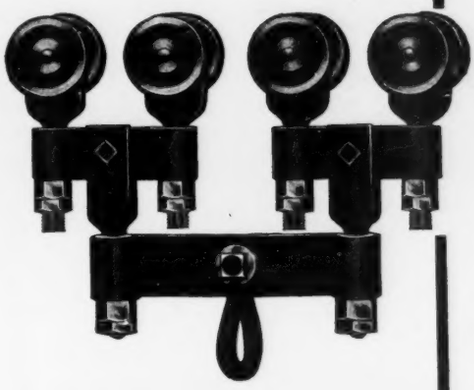
QUEEN'S RUN FIRE BRICK CO.

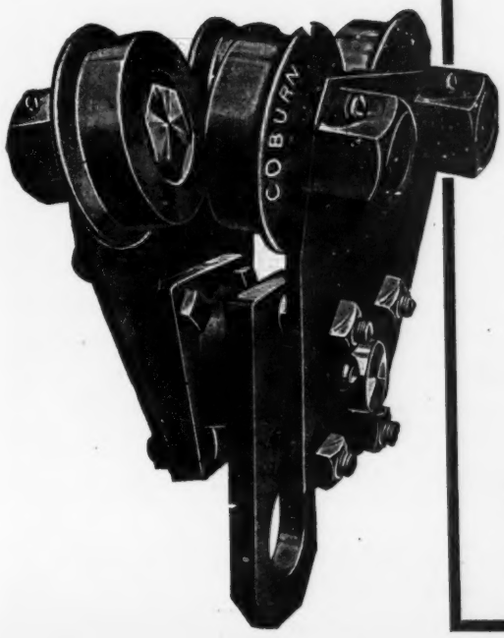
Lock Haven **Penna.**

ORGANIZED 1836









FOUNDRIES completely equipped with *Coburn Overhead Trolley Equipment* are foundries working on the *highest efficiency basis.* They are foundries which are utilizing for actual production, every inch of floor space by carrying on their transportation overhead.

COBURN
TROLLEY TRACK EQUIPMENT

Coburn Trolley Track Equipment does away with floor confusion and delay in handling ladles of iron, flasks, sand or castings, because the tracks of this system are overhead and cannot become blocked.

The time and confusion saved by an installation of this kind will soon pay for itself.

Coburn Trolley Tracks are constructed with I Beam or Round Trough, and equipped with carriers, hoists or cranes.

Write for our complete catalog.

COBURN
Trolley Track Mfg. Co.
Holyoke, Mass.

Sterling

Built For Your Foundry

No. 85—For Sand Cores

As compared with tote boxes, or any method of hand-carrying cores, this wheelbarrow will treble your carrying capacity, and soon save its cost through saving of time and labor. Three full elliptic springs protect the cores against breakage.

No. 28—For Castings

This Barrow defies rough treatment. It is built to withstand continuous hard service. Note the Boiler Plate Tray Support, and Double-Tire Wheel. Buy this Barrow for permanence.

No. 17—For Pig Iron

An enormous load of pig iron can be wheeled in this barrow, as it is so designed that the load is carried over the wheel. The wheel is fortified by a Double-Tire. All braces are extra heavy, and the platform is of more than sufficient strength to stand the maximum carrying capacity.

Sterling Wheelbarrows Are Made in a Variety of Sizes and Styles to Meet All Foundry Requirements.

Please Write for Catalogues, and Get Acquainted with the Complete Line of Sterling Barrows, Flasks, Trucks, Etc.

STERLING WHEELBARROW COMPANY

STERLING ON A WHEELBARROW MEANS MORE THAN STERLING ON SILVER

Milwaukee Wisconsin

ALLIED Allied Construction Machinery Corporation ALLIED

CYCLONE HOISTS

"Good-bye, Boss, We Take Your Money and Go Home"

UNSKILLED laborers are returning in hordes to the countries which are really "home" to them.

But the American manufacturer, if he will take advantage of the modern labor-saving appliances offered for his consideration, need not feel the loss of unskilled labor to any extent.

The manufacturer who installs mechanical appliances to take the place of laborers knows that such appliances are not going to strike, get drunk or loaf on the job.

One man and a Cyclone Hoist will do the work that formerly required a gang.

Cyclone Hoists are built in convenient sizes to lift any weight up to 40 tons. Used in connection with C-M "Matchless" Trolleys and C-M Travelling Cranes they will speed up your production, cut your costs, and do away with a lot of restless, undependable labor.

Write for catalog of C-M products that will reduce your hoisting and conveying costs.

The Chisholm-Moore Mfg. Co
Cleveland, O.

Hoists Cranes Trolleys

Branch Offices:

New York
30 Church St.

Pittsburgh
Henry W. Oliver Bldg.

Chicago
Peoples Gas Bldg.

GRAND CENTRAL PALACE

The Concentrated World Market

THE INTERNATIONAL **MACHINERY** EXPOSITION

offers

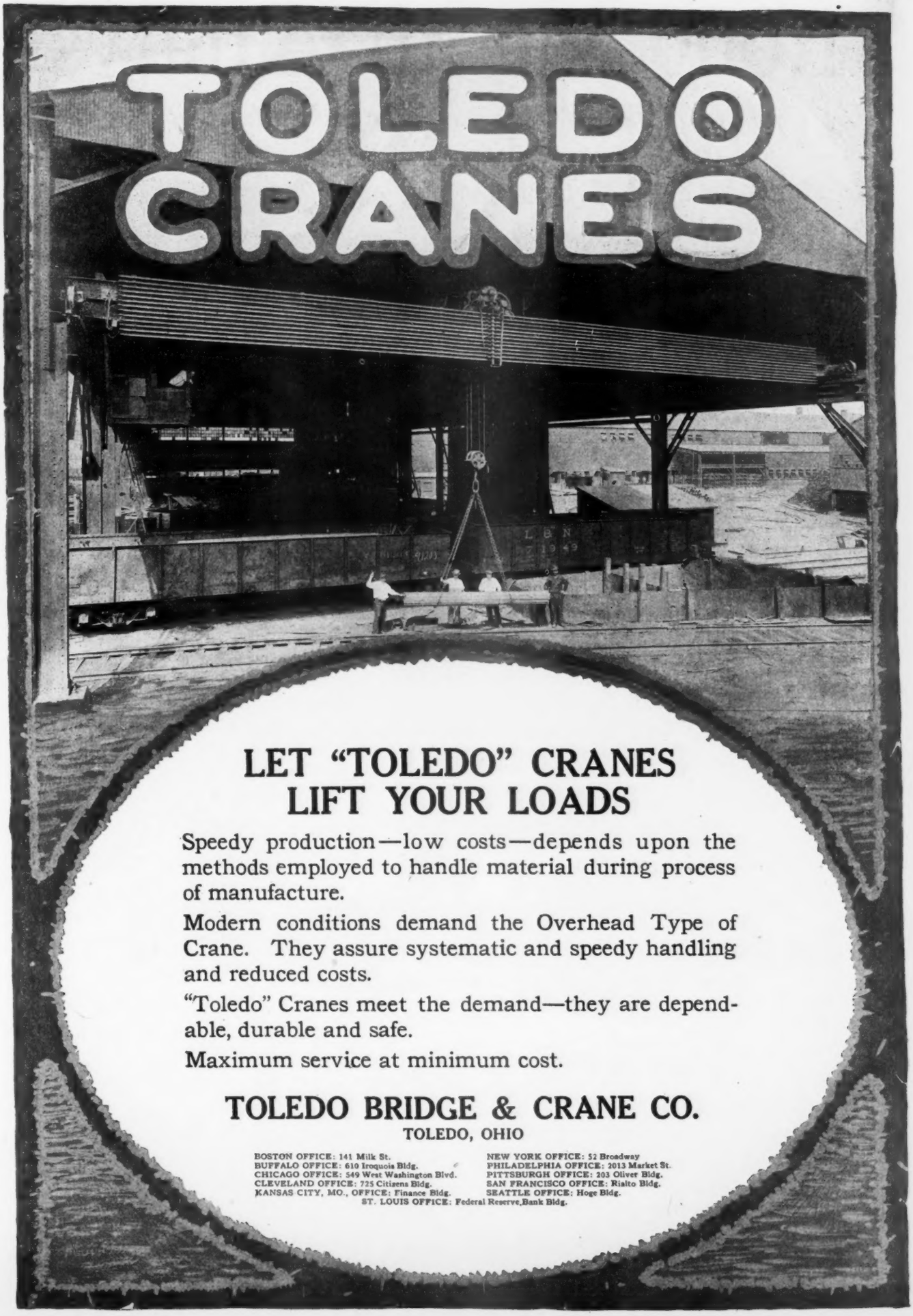
Manufacturers of machine tools and iron working machinery, textile machinery, wood working machinery of all classes, mining machinery, can making and canning machinery, factory, foundry, power plant and all mechanical appliances an opportunity to

DISPLAY PRODUCTS RIGHT IN THE HEART OF THE WORLD'S MACHINERY MARKET

New York is the market for machinery, tools and equipment. Buyers from all over this country and other countries come here because it is the center of the export trade and the home of domestic trade associations and buyers' clubs. Heretofore New York has had no central location where all lines of machinery and appliances could be assembled under one roof for the inspection of buyers. Now the machinery exposition is established at Grand Central Palace, the most famous exposition building in the world.

Have you secured floor space?
Write for floor plan and prices.

INTERNATIONAL MACHINERY EXPOSITION
GRAND CENTRAL PALACE



LET "TOLEDO" CRANES LIFT YOUR LOADS

Speedy production—low costs—depends upon the methods employed to handle material during process of manufacture.

Modern conditions demand the Overhead Type of Crane. They assure systematic and speedy handling and reduced costs.

"Toledo" Cranes meet the demand—they are dependable, durable and safe.

Maximum service at minimum cost.

TOLEDO BRIDGE & CRANE CO.

TOLEDO, OHIO

BOSTON OFFICE: 141 Milk St.
BUFFALO OFFICE: 610 Iroquois Bldg.
CHICAGO OFFICE: 549 West Washington Blvd.
CLEVELAND OFFICE: 725 Citizens Bldg.
KANSAS CITY, MO., OFFICE: Finance Bldg.
NEW YORK OFFICE: 52 Broadway
PHILADELPHIA OFFICE: 2013 Market St.
PITTSBURGH OFFICE: 203 Oliver Bldg.
SAN FRANCISCO OFFICE: Rialto Bldg.
SEATTLE OFFICE: Hoge Bldg.
ST. LOUIS OFFICE: Federal Reserve Bank Bldg.

$1,000 for an Analysis

A Committee appointed by the Society of Industrial Engineers will make three awards: $1,000, $500, $250. Competition closes January 30th, 1920

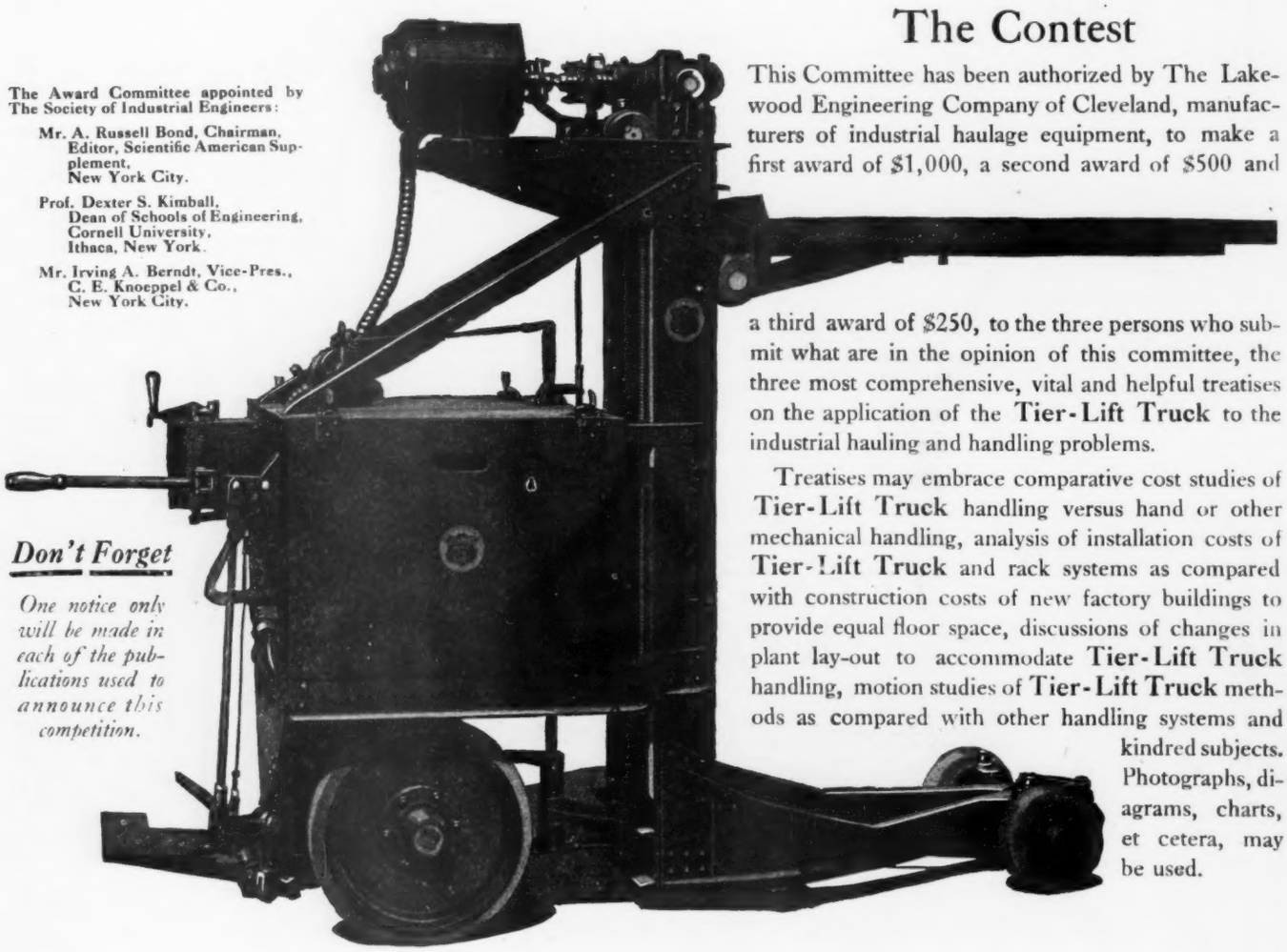
TO get increased production in the face of the present man-power shortage is uppermost in the minds of business executives. Employer or employee, you ought to *Analyse Your Own Production and Labor Problems.* If this contest induces only managers, engineers, and others to study *Industrial Haulage Methods, it will have done something worth while.*

The Award Committee appointed by The Society of Industrial Engineers:

Mr. A. Russell Bond, Chairman, Editor, Scientific American Supplement, New York City.

Prof. Dexter S. Kimball, Dean of Schools of Engineering, Cornell University, Ithaca, New York.

Mr. Irving A. Berndt, Vice-Pres., C. E. Knoeppel & Co., New York City.



Don't Forget

One notice only will be made in each of the publications used to announce this competition.

The Contest

This Committee has been authorized by The Lakewood Engineering Company of Cleveland, manufacturers of industrial haulage equipment, to make a first award of $1,000, a second award of $500 and a third award of $250, to the three persons who submit what are in the opinion of this committee, the three most comprehensive, vital and helpful treatises on the application of the **Tier-Lift Truck** to the industrial hauling and handling problems.

Treatises may embrace comparative cost studies of **Tier-Lift Truck** handling versus hand or other mechanical handling, analysis of installation costs of **Tier-Lift Truck** and rack systems as compared with construction costs of new factory buildings to provide equal floor space, discussions of changes in plant lay-out to accommodate **Tier-Lift Truck** handling, motion studies of **Tier-Lift Truck** methods as compared with other handling systems and kindred subjects. Photographs, diagrams, charts, et cetera, may be used.

Conditions Governing the Competition

THE competition is open to anyone except employees of The Lakewood Engineering Company. That company reserves the right to use any manuscript submitted. Only one award will be made to a contestant. Each contestant may submit as many articles as he desires.

Contestants are requested not to seek from The Lakewood Engineering Company or elsewhere, other information pertaining to the **Tier-Lift Truck** than that shown on the opposite page. Only data based on the information presented will be given consideration.

Send your manuscript to Mr. A. Russell Bond, Chairman, Award Committee, Editor, Scientific American Supplement, New York City.

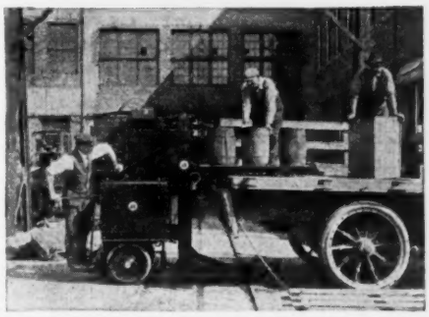
Write the title of your treatise on the first page of your manuscript. Do not write your name on the manuscript. On a card in a separate sealed envelope send your name, the title of your treatise, (the same title as that appearing on the manuscript), your business connection, and your address.

The contest closes January 30th, 1920. Manuscripts received after that date will not be permitted in the competition. Awards will be made prior to February 28, 1920.

Here's the Problem to Solve

How can You Use the Tier-Lift Truck in your Business?
Read Contest Conditions on the Opposite Page.

Straight Trucking



Lifting for Delivery

Tiering with Experimental Racks
(Heavy-Compact)

Tier-Lift Truck Lifting Platform
Partly Elevated

Trucking

Carries a load of 4,000 pounds which it hauls and lifts.

Travels without load three to six and one-half miles per hour (260 to 570 feet per minute.)

Travels with 4,000 pound load at two and one-half to five miles per hour. (220 to 440 feet per minute.)

Lifting

Lifts and carries loads up to 4,000 pounds from 11 inches to 76 inches from the floor or to intermediate heights.

Lifts 4,000 pounds at the rate of one inch in 1.5 seconds, or one foot in 18 seconds. Lifts five inches, (average clearance height,) in 7.5 seconds.

Loaded or unloaded, platform lowers at the rate of approximately 2 inches per second.

Tiering

Tiers mechanically in conjunction with racks designed to meet factory conditions. Tier-Lift truck platform dimensions are 54 inches in length, 26 inches in width, 3½ inches in thickness beyond the supports and 8 inches at the braced end.

The use of trays permits wide variation in design of racks.

Three Tiering Heights

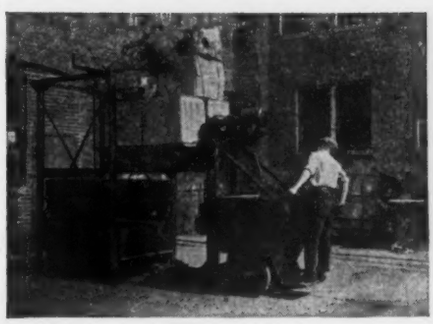
The Tier-Lift Truck is made in three standard tiering heights of platform: 42, 60 and 76 in. This gives overall heights of 61½, 79½ and 96¼ in., respectively.

Dimensions, Weight and other Data

Over-all length (with folding steering handle extended) 121½". Over-all width 36 inches. Clearance under truck 3 inches. Weight (including batteries for 8 to 10 hour continuous operation) 3030 pounds. Minimum turning radius (extreme outside corner) 92 inches. All operations mechanical, electrically controlled by one operator.

Trucking with Trays

Lifting for Storage



Tiering with Experimental Racks
(Light Bulky)

Travels Backward and Forward

One notice only will be made in each of the publications used to announce this competition

Get Busy Today, The Competition Closes January 30, 1920

This is a Welded Joint

It is a muntin joint of Pond Continuous Sash, unretouched.

Maybe it doesn't look as slick as a riveted joint, though it certainly costs more. But it is a lot stronger, because not punched, and a lot more durable, because no rust can enter to loosen it. It's **integral,**—no longer a "joint" but one solid piece of metal.

The same process is used for the joints of Lupton Counterbalanced Sash and Counterweighted Sash. We use it because the high quality and permanence of these types of sash in other respects deserves the best form of joint we can find.

If you want **real** welded joints in the sash you buy, there are two ways to get them. One is to specify gas-welded or arc-welded joints in the contract. The other is to specify Lupton Counterbalanced and Counterweighted or Pond Continuous Sash.

Pond Continuous Sash in a Pond Truss Roof

DAVID LUPTON'S SONS COMPANY

Clearfield and Janney Sts. Philadelphia, Pa.

Specialists in daylighting and ventilating equipment for maximum production.

Chicago New York Cleveland Boston
Detroit Washington Pittsburgh

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Saginaw Products Co. *Saginaw, Mich.*

Light and Ventilation

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Electric Steel Co., Chicago, Ill.
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"A Continuous Foundry for Automobile Castings" is the title of an interesting booklet we recently published.

Ask for a Copy

Foundrymen appreciate the value of good light and ventilation, because these features tend to reduce labor turn-over, and increase the percentage of good castings produced.

The cleaning room therefore, instead of being merely the dark corner of the foundry, now-a-days receives its due consideration. The illustration above shows a cleaning room built by us that embodies modern ideas. Any man would be glad to work in it.

We know what good foundry design is, and work with you to its achievement. Our service spells economy, and is worth learning about if you need more foundry capacity.

FRANK D. CHASE, Inc.

INDUSTRIAL ENGINEERS

CHICAGO: 645 N. MICHIGAN AVE. WHITEHALL BUILDING: NEW YORK

WHAT ARE YOUR COMPLICATIONS?

Proper organization for utmost success demands always that factor offering greatest complication be immediately recognized and corrected through concentration.

Has That Factor Been Recognized in *Your* Business?

1st Is it that your organization does not function *smoothly* and *harmoniously*?

2nd Is it that you do not know what your production should *be* as compared with *what it is*?

3rd Is it that your production effort is not *controlled* and *visualized* so as to secure maximum results?

4th Is it that your cost records are not complete, accurate and prompt or that they do not serve *all* three functions, financial, sales and manufacturing as they should?

5th Is it that your plant layout processes, facilities or equipment, are not designed and arranged for *greatest results*?

6th Is a lack of co-operation between *workers* and *employer* in your company?

What Is It?

If you *do not* know what it is let us show you how our industrial survey finds it.

If you *do* know what it is let us tell you about our plan of service which brings to you a programme for immediate, definite, effective and positive correction.

A word will bring us to your office by mail or in person.

"Knoeppel Organized Service"

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35 years experience in engineering and construction work.
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ENGINEERS and CONSTRUCTORS
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Extensions to Machine Shop, new Erecting Shop, Storage Building, Power Plant
Design and Construction by W C K

PRODUCTION

Is Your Production Failing to Meet Demand?

If the demand for your products exceeds the capacity of your present plant and you wish to increase production we will do for you what we are doing for many manufacturers in a similar situation.

First we will make an engineering study of your plant and make recommendations for extensions if such are required. We will then design and construct the additions.

The service which we can perform is thus complete, extending from the preliminary study to the last brushful of paint on the finished work.

"Work Done"—shortly to be issued—pictures some of the plants we have extended, as well as many new plants which we have designed and built complete. If you contemplate plant construction of any kind we shall be glad to send a copy of this book.

Westinghouse, Church, Kerr & Co., Inc.

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WASHINGTON CHICAGO DALLAS SAN FRANCISCO MONTREAL

"CUPOLA TROUBLE"

Are you having trouble in the foundry with your CUPOLA?

Is your Iron hot enough?

Are you able to melt the rated capacity of the Cupola?

Are you having trouble Slagging?

Is your Lining burning out?

If So, We Can Help You

With our IMPROVED TUYERES and System of Lining, the Cupola runs very easily, the blast is soft, the linings do not cut, the Cupola slags freely, there is no bridging or hanging, and the iron sparkles when it comes from the spout.

A Battery of Cupolas equipped with our TUYERES and Lined according to our System will only require about one-half of the Horsepower ordinarily used. They will melt the full rated capacity of the Cupolas and generally a slight excess, and the iron will be hot. The Consumption of Coke will be in accordance with good practice. The ease of operation will be phenomenal.

WRITE FOR PARTICULARS

The Clement A. Hardy Company

Foundry Engineers

654 Railway Exchange Bldg. Chicago, Ill.

TRUSCON FOUNDRY FLASKS

HEAVY PRESSED STEEL OF IMPROVED DESIGN

Truscon Improved Pressed Steel Foundry Flasks have many features which especially appeal to every progressive foundryman. Rust-resisting steel plates of substantial thickness are used to insure long life. Maximum strength is obtained by exceptionally deep ribs and flanges.

The ribs and flanges extend the full depth around the corners without buckling or cutting away the metal, thus providing a corner of exceptional strength. The meeting parts of the flask are all welded. The pinholders are of malleable iron and, together with the handles, are securely riveted to the flask.

The flange on the filling side is turned outward so as not to interfere with ramming the molding sand or hold it when shaken out. The flange on the bottom side is turned inward, holding the sand in place when the flask is lifted. The shape of the stiffening ribs also is designed to simplify filling and to hold the sand in place. These ribs, although appearing circular in the photographs, are actually quite steep on the upper half and comparatively flat on the lower half.

Circular Truscon Foundry Flask

Truscon Pressed Steel Foundry Flasks are furnished in a large variety of sizes and shapes. Leading foundries have adopted Truscon Flasks. We invite inquiries. Write for quotations.

Typical Truscon Foundry Flask

Pressed Steel Department

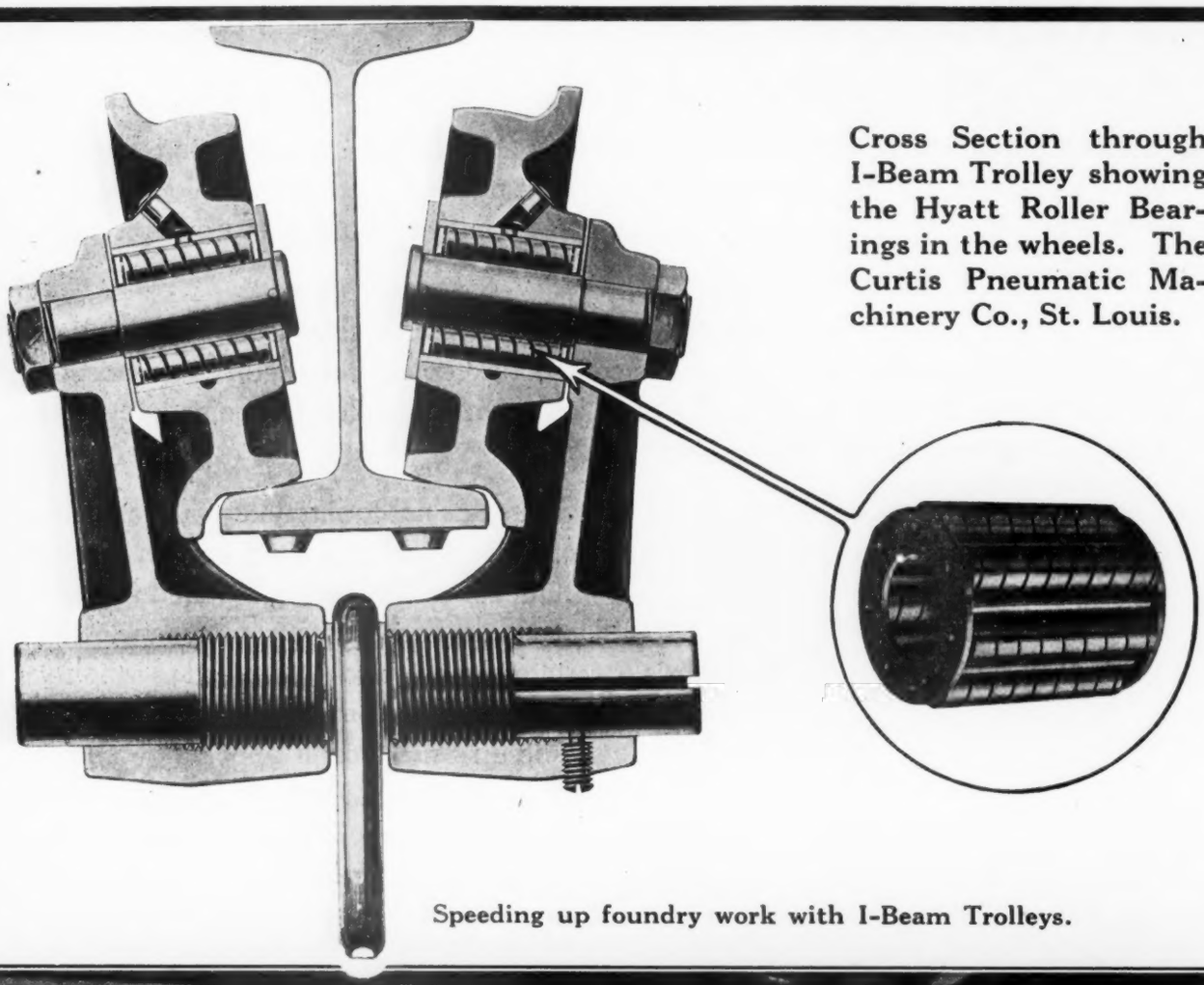
Truscon Steel Co.

Youngstown, Ohio

TRUSCON STEEL CO. TRUSCON PRESSED STEEL

Truscon Foundry Flask especially designed for Pistons.

ECONOMICAL TROLLEY OPERATION



Cross Section through I-Beam Trolley showing the Hyatt Roller Bearings in the wheels. The Curtis Pneumatic Machinery Co., St. Louis.

Speeding up foundry work with I-Beam Trolleys.

Hyatt Roller Bearings for

MEANS HYATT ROLLER BEARINGS

The handling of material to and from machines and from department to department, during the process of manufacture, is one of the most important items entering into the cost of production. The economy and labor saving value of I-beam trolleys for this purpose is universally recognized.

In order to secure the most economical results from such a trolley system, it is essential that the trolleys be easy starting and easy running, thoroughly dependable and capable of years of satisfactory operation.

That is why HYATT ROLLER BEARINGS are a logical and necessary part of every durable, dependable, quality trolley.

Hyatt Roller Bearings are rugged, practical bearings that eliminate over 50% of the dragging friction of plain bearings. They assure an easy starting and easy running trolley. These modern bearings require lubrication only three or four times a year. Their durability is such that they operate for years with an absolute minimum of attention.

In other words, Hyatt Roller Bearings have all the qualities that are essential for modern, efficient, economical trolley operation—they are easy running, durable, self lubricating, dependable.

It will pay you to specify modern, economical trolleys—those equipped with Hyatt Roller Bearings.

MOTOR BEARINGS DIVISION
DETROIT, MICH.

HYATT ROLLER BEARING COMPANY
INDUSTRIAL BEARINGS DIVISION
METROPOLITAN TOWER, NEW YORK

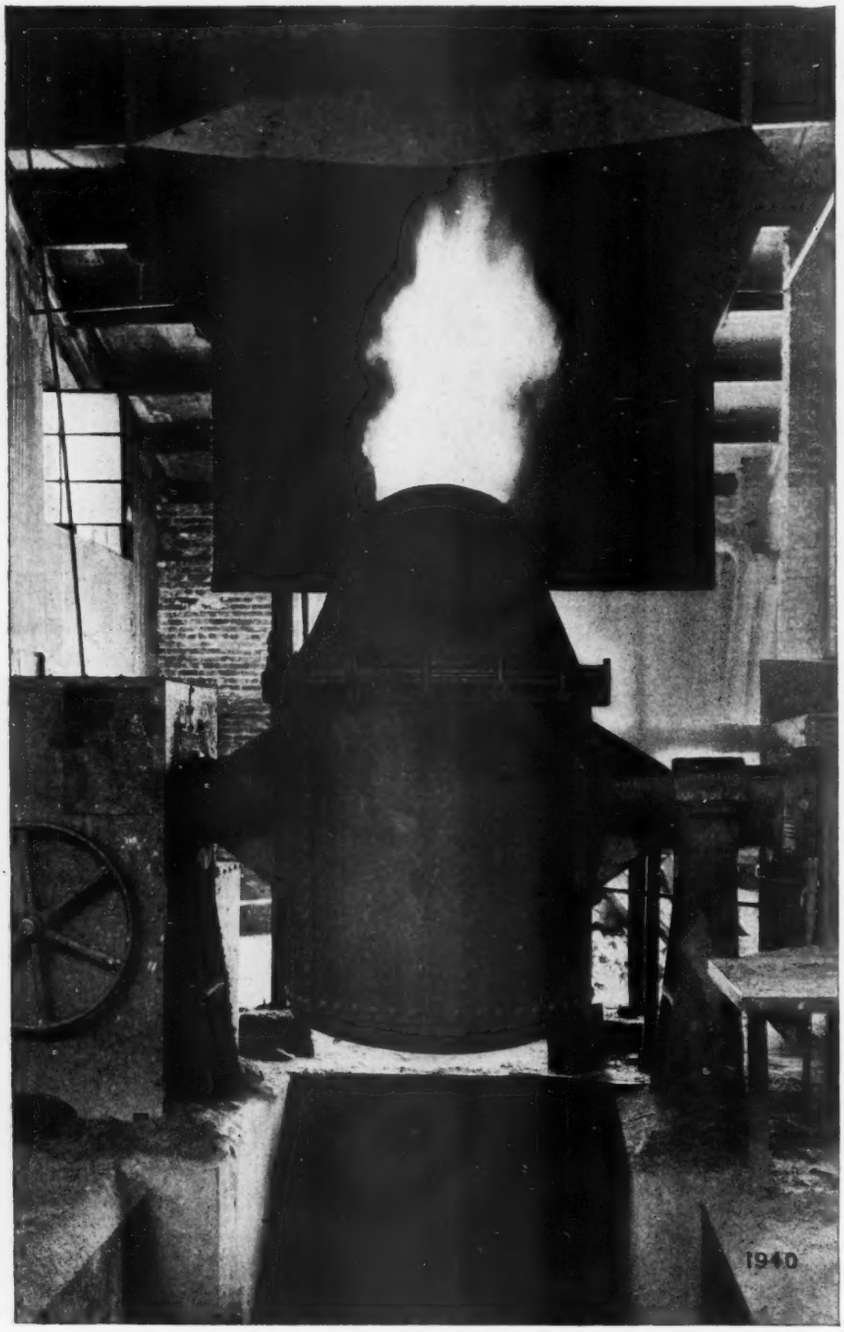
TRACTOR BEARINGS DIVISION
CHICAGO, ILL.

Manufacturers of Bearings for Mine Cars, Ore Cars, Steel Mill Cars, Roller Tables, Trolleys, Cranes, Hoists, Machine Tools, Line Shafts, Countershafts, Concrete Machinery, Textile Machinery, Conveyors, Lift Trucks, Industrial Trucks, Railway Service Cars, Storage Battery Locomotives, etc.

765

Cranes, Trolleys and Hoists

Easy to Make Steel Castings



1-ton Whiting Converter in Operation. Unretouched photo of flame during carbon period. W. F. E. Co., Harvey, Ill.

You can make steel castings right in your own foundry by installing a Whiting Side-Blow Converter. It is no mystery to produce good steel castings ranging from 1 lb. to 4000 lbs. each, of practically any analysis,

with a

WHITING CONVERTER

In many foundries a converter can be placed in the same building, securing the use of cranes and other equipment already installed.

And you can operate intermittently or every day according to your needs.

Does not require a high-priced operator or large tonnage to get good results.

Our new catalog No. 150 fully describes the converter process, containing an outline of a typical day's run, and layouts of complete plants.

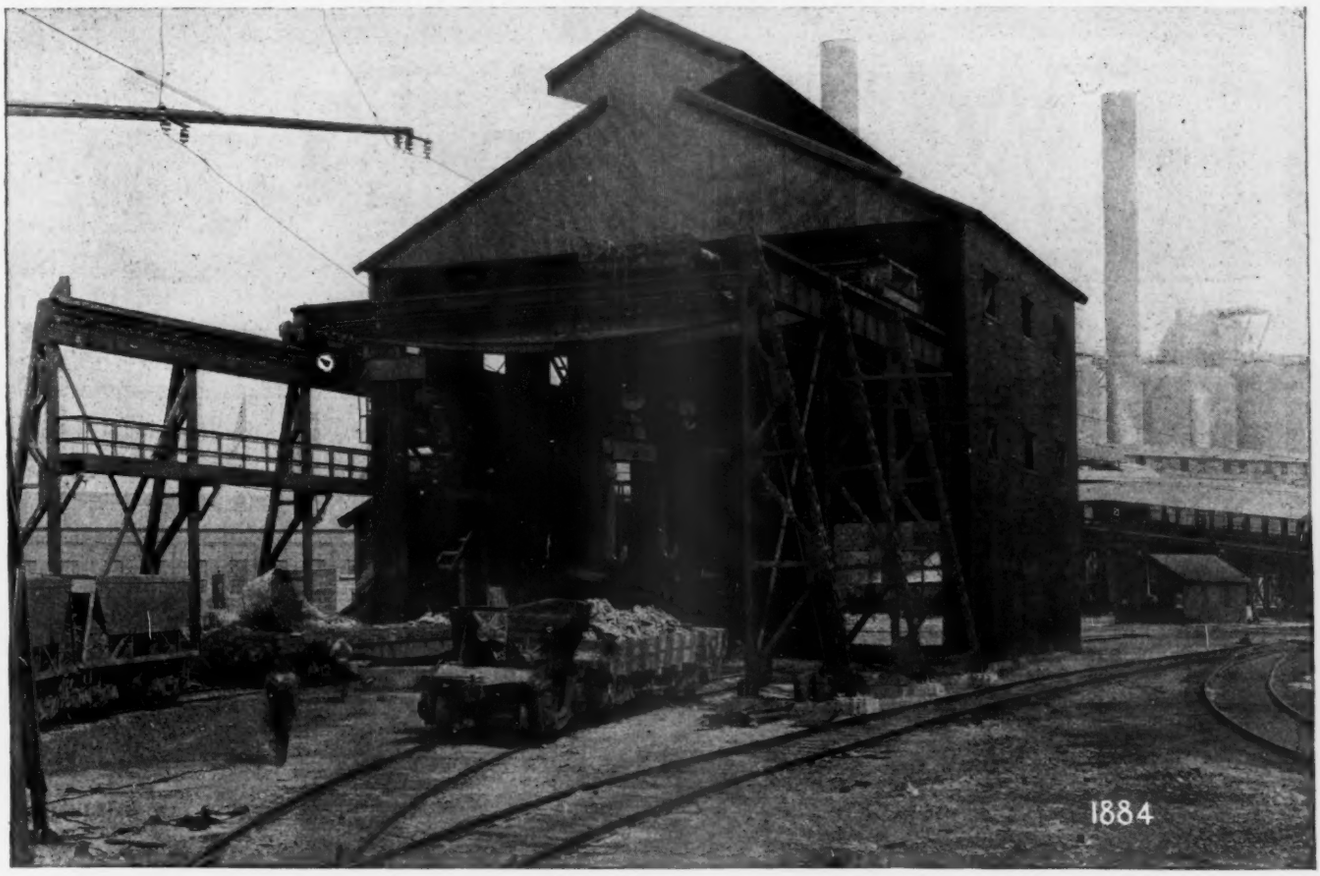
Send for a copy.

WHITING FOUNDRY EQUIPMENT CO.
Harvey (Chicago Suburb) Ill.

See Page 77

WHITING

CRANES OF ALL TYPES / FOUNDRIES EQUIPPED COMPLETE



WHITING CRANES

WHITING
FOUNDRY EQUIPMENT CO
HARVEY-ILL. U.S.A.
CHICAGO SUBURB

CRANES

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Tumblers Ladles
Core Ovens & C. O. Cars
Trucks Turntables
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FOR HEAVY DUTY

This 40-ton Whiting crane with type "R" trolley is in service in ladle house, Iroquois Iron Co., South Chicago, Ill. The type "R" is being used in all kinds of service but is especially suitable for foundries and iron-working plants, where its enclosed construction keeps out dirt and dust from the gearing.

Send for Catalog 130

WHITING FOUNDRY EQUIPMENT CO.
Harvey (Chicago Suburb) Ill.

See page 76

WHITING
CRANES OF ALL TYPES / FOUNDRIES EQUIPPED COMPLETE

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A classified-by-products list of advertisers for the convenience of readers. If you don't find what you want, write us and we will tell you where to get it. ¶ Index to advertisements will give you page number of any advertiser and by referring to advertisement you can get full particulars about products.

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Harrison Bros., Inc., Amesbury, Mass.
Harrison Supply Co., 5 and 7 Dorchester, Boston.
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Kawin, Chas. C., Company, Chicago, Ill.
Sly, W. W., Mfg. Co., 4700 Train Ave., Clevel'd.

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Gibb Instrument Co., 348 Palmer Ave., Detroit, Mich.

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Pettinos, George F., Real Estate Bldg., Phila.
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Knickerbocker Co., 516 Liberty St., Jackson, Mich.
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BUCKETS (Drag Line)
Brosius, Edgar E., Pittsburgh, Pa.

BUCKETS (Foundry)
Biehl Iron Works, Inc., The, Reading, Pa.

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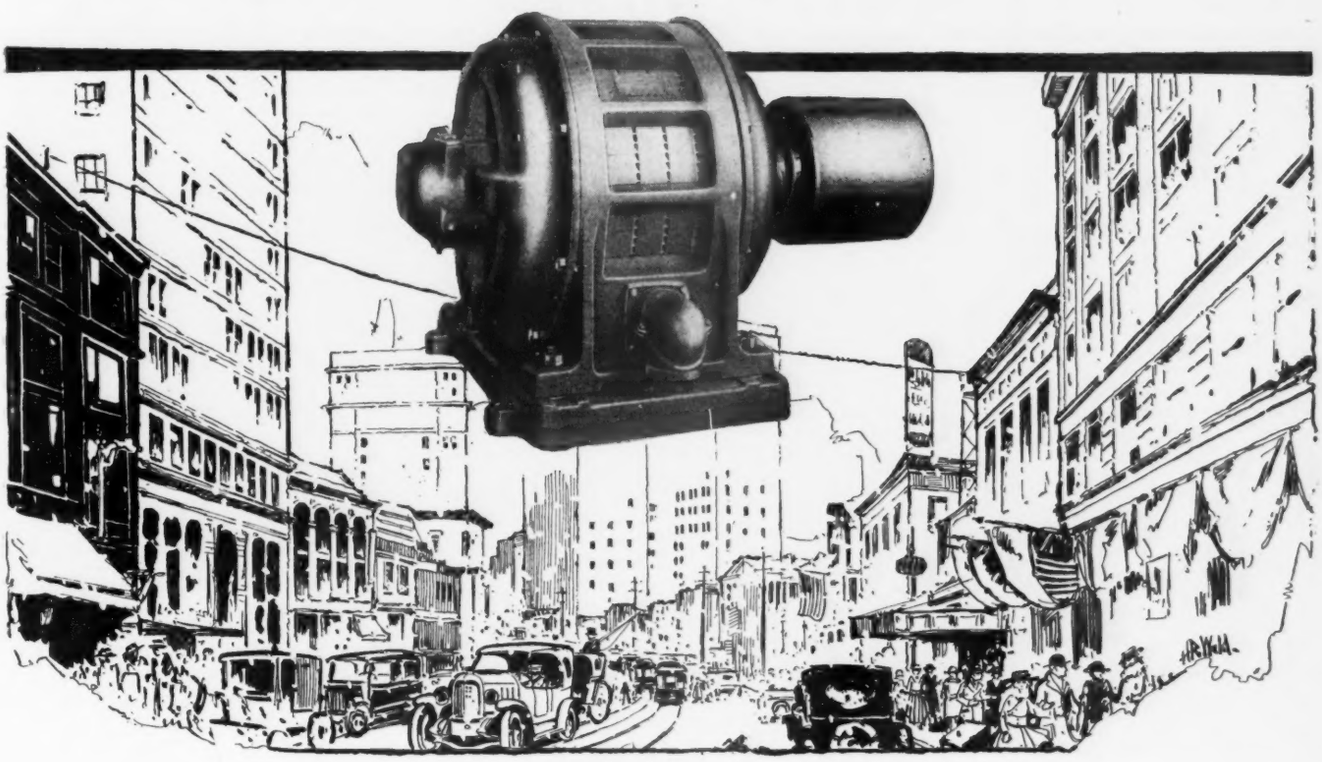
Users want serviceable, durable, available G-E Motors that embody all features long experience has shown to be necessary



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An Able Motor

G-E polyphase induction motors have been more widely used than any others for well over a quarter century. In every industry they are known to be most dependable, even when operating under wet and gritty operating conditions.

Some of the first motors installed are still in daily operation, while many have come through fires and floods undamaged so no one knows how durable they are—probably no one will live long enough to find out.

And these motors are available. You will find them stocked in all large cities with experts on their application near at hand to freely advise you.

General Electric Company

General Office Schenectady, N.Y.

43-145

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Paxson, J. W., Co., Philadelphia, Pa.
Pettinos, Chas. E., 25 Church St., New York City.
Pettinos, George F., Real Estate Bldg., Phila.
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Detroit Soluble Oil Co., Beard & M. C. Ry., Detroit, Mich.
Diamond Oil Co., Inc., Philadelphia, Pa.
Federal Foundry Supply Co., 2639 E. 79th St., Cleveland, O.
Grace-Lynn Co., Blackstone Bldg., Cleveland, O.
Kellogg, Spencer & Sons, Buffalo, N. Y.
Kelly, T. P., & Co., Inc. 355 West 26th St., New York, N. Y.
Paxson, J. W., Co., Philadelphia, Pa.
Smith, Werner G., Co., Cleveland, O.
Sterling Oil Corp., 680 Swan St., Buffalo, N. Y.
Stevens, Frederic B., Detroit, Mich.
Swan & Finch Co., 165 Broadway, New York City.
Union Petroleum Co., Philadelphia, Pa.
Woodison, E. J. Co., Detroit, Mich.

CORE OVENS
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Holcroft & Co., Book Bldg., Detroit, Mich.
Sly, W. W., Mfg. Co., 4700 Train Ave., Clevel'd.
Stevens, Frederic B., Detroit, Mich.
Wadsworth Core Mach. & Equip. Co., Akron, O.
Whiting Fdy. Equipment Co., Harvey, Ill.
Young Brothers Co., Detroit, Mich.

CORE OVEN CAR PULLER
Whiting Foundry Equipment Co., Harvey, Ill.

CORE REDUCERS
National Engineering Co., Machinery Hall Bldg., 549 W. Washington St., Chicago, Ill.

CORE RODS
Franklin Core Rod & Gagger Co., Buffalo and Third St., Franklin, Pa.

CORE SAND MIXERS
Dunning & Boschert Press Co., Inc., The, 328 West Water St., Syracuse, N. Y.
National Engineering Co., Machinery Hall Bldg., 549 W. Washington St., Chicago, Ill.

CORE TESTING MACHINES
Wadsworth Core Machine & Equip. Co., Akron, O.

CORE WASH
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Federal Foundry Supply Co., 2639 E. 79th St., Cleveland, O.
Kelly, T. P., & Co., Inc., 355 West 26th St., New York, N. Y.
Obermayer, S., Co., 2563 W. 18th St., Chicago.
Pettinos, Chas. E., 25 Church St., New York City.
Pettinos, George F., Real Estate Bldg., Phila.
Stevens, Frederic B., Detroit, Mich.
United States Graphite Co., Saginaw, Mich.
Woodison, E. J., Co., Detroit, Mich.

CORE WAX
United Compound Co., 228 Elk St., Buffalo, N. Y.

CORRESPONDENCE SCHOOLS
McLain's System, Inc. 803 Goldsmith Bldg., Milwaukee, Wis.

COUPLINGS (Flexible)
P. H. & F. M. Roots Co., Connersville, Ind.

CRANES
Chesapeake Iron Works, Baltimore, Md.
Green, L. A., Sales Agent, First National Bank Bldg., Pittsburgh, Pa.
Link-Belt Company, Chicago, Ill.
Northern Engineering Works, 4 Chene St., Detroit.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Fdy. Equipment Co., Harvey, Ill.

CRANES (Bucket)
Link-Belt Company, Chicago, Ill.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES (Electric Traveling)
Box, Alfred, & Co., Inc., Philadelphia, Pa.
Brosius, Edgar E., Pittsburgh, Pa.
Chesapeake Iron Works, Baltimore, Md.
Link-Belt Company, Chicago, Ill.
Milwaukee Electric Crane & Mfg. Co., Milwaukee.
Northern Engineering Works, 4 Chene St., Detroit.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Fdy. Equipment Co., Harvey, Ill.

CRANES (Hand Traveling)
Coburn Trolley Track Mfg. Co., The, Holyoke, Mass.
Chisholm-Moore Mfg. Co., Cleveland, O.
Milwaukee Electric Crane & Mfg. Co., Milwaukee.
Northern Engineering Works, 4 Chene St., Detroit.
Paxson, J. W., Co., Philadelphia, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

CRANES (Jib)
Northern Engineering Works, 4 Chene St., Detroit.
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Whiting Fdy. Equipment Co., Harvey, Ill.

CRANES (Locomotive)
Link Belt Co., Chicago, Ill.

CRANES (Monorail)
Northern Engineering Works, 4 Chene St., Detroit, Mich.

CRANES (Wall)
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRUCIBLES
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Woodison, E. J., Co., Detroit, Mich.

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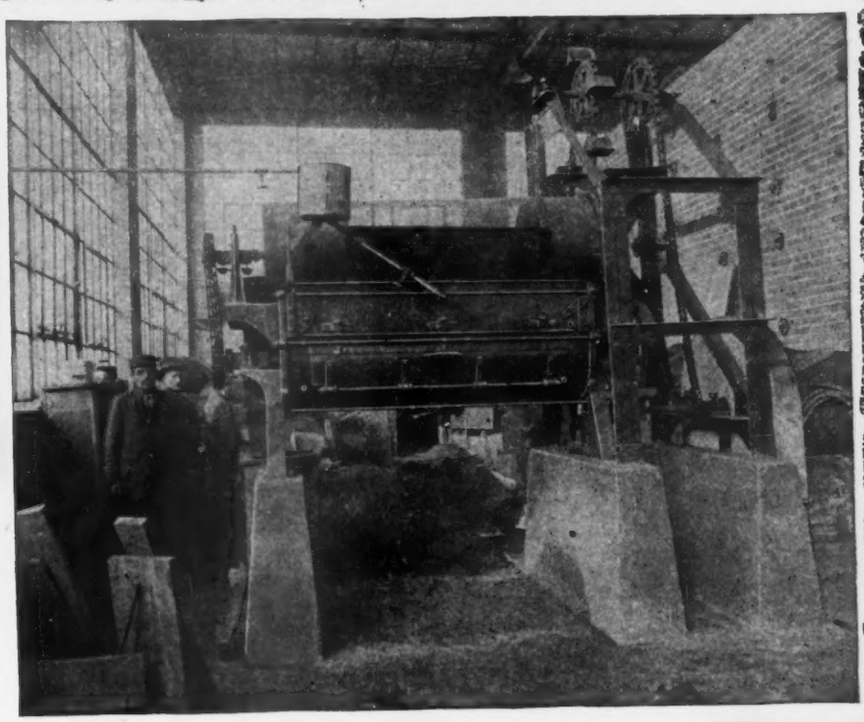
Takes one man to operate — Does the work of twenty.



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Stevens, Frederic B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

CUPOLA CHARGING MACHINE
Whiting Foundry Equipment Co., Harvey, Ill.

CUPOLA CONTROL
Stoughton Process Co.,
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CUPOLA DAUB
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Northern Eng. Works, 4 Chene St., Detroit, Mich.
Paxson, J. W., Co., Philadelphia, Pa.
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Whiting Fdy. Equipment Co., Harvey, Ill.

CUTTERS (Steel)
Moltrup Steel Products Co., Beaver Falls, Pa.

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—See WELDING AND CUTTING EQUIPMENT (Electric Arc)

CUTTING AND WELDING (Oxy-Acetylene)
—See WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene Process)

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Macleod Co., Bogen St., Cincinnati, O.

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—See ACETYLENE IN CYLINDERS

CYLINDERS (Oxygen)
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DEOXIDIZERS
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Independent Pneumatic Tool Co.,
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1037 Fisher Bldg., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.
Independent Pneumatic Tool Co.,
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Knickerbocker Co., 516 Liberty St., Jackson, Mich.
Macleod Co., Bogen St., Cincinnati, O.
Mott Sand-Blast Mfg. Co., Inc., New York.
Pangborn Corporation, P. O. Box 851,
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Sly, W. W., Mfg. Co., 4700 Train Ave., Clevel'd.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Whiting Fdry. Equipment Co., Harvey, Ill.

DYNAMOS
General Electric Co., Schenectady, N. Y.

ELECTRICAL EQUIPMENT
Lincoln Electric Co., The,
E. 38th St. and Kelly Ave., Cleveland, O.

ELECTRIC ARC EQUIPMENT (For Cutting and Welding)
Lincoln Electric Co., The,
E. 38th St. and Kelly Ave., Cleveland, O.

ELECTRIC GENERATING SETS
General Electric Co., Schenectady, N. Y.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

ELECTRO PLATERS' EQUIPMENT AND SUPPLIES
Bennett & Seeley, Bridgeport, Conn.

ELEVATORS
Link Belt Co., Chicago, Ill.

ELEVATORS (Bucket)
Bartlett, C. O., & Snow Co., Cleveland, O.

ENGINEERS (Consulting)
Booth Electric Furnace Co.,
314 So. Dearborn St., Chicago, Ill.
Chase, Frank D., Chicago, Ill.
Knoeppel, C. E. & Co., Inc.,
6 East 39th St., New York, N. Y.
Mason, Carlisle, Inc., 207 Broadway, N. Y. C.
Price, T. W., Engrg. Co.,
Woolworth Bldg., New York City.
Westinghouse-Church-Kerr & Co.,
37 Wall St., New York, N. Y.

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Knoeppel, C. E. & Co., Inc.,
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Westinghouse-Church-Kerr & Co.,
37 Wall St., New York, N. Y.

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Chase, Frank D., Chicago, Ill.
Grimes Molding Machine Co.,
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Kawin, Chas. C., Co., Chicago, Ill.
Knoeppel, C. E. & Co., Inc.,
6 East 39th St., New York, N. Y.
Mason, Carlisle, Inc., 207 Broadway, N. Y. C.
National Engineering Co., Machinery Hall Bldg.,
549 W. Washington St., Chicago, Ill.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Price, T. W., Engrg. Co.,
Woolworth Bldg., New York City.
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Standard Sand & Machine Co., Cleveland, O.
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1037 Fisher Bldg., Chicago, Ill.

ENGINES (Steam)
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

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314 So. Dearborn St., Chicago, Ill.
Chase, Frank D., Chicago, Ill.

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Gibb Instrument Co.,
348 Palmer Ave., Detroit, Mich.

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EXHAUST SYSTEMS
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Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Sly, W. W., Mfg. Co., 4700 Train Ave., Clevel'd.

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Grand Central Palace, New York, N. Y.

EYE PROTECTORS
King, Julius, Optical Co.,
12 Maiden Lane, New York, N. Y.

FACINGS
Asbury Graphite Mills, Asbury, N. J.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Federal Foundry Supply Co.,
2639 E. 79th St., Cleveland, O.
Kelly, T. P., & Co., Inc.,
355 West 26th St., New York, N. Y.
Obermayer, S., Co., 2563 W. 18th St., Chicago.
Pettinos, Chas. E., 25 Church St., New York City.
Pettinos, George E., Real Estate Bldg., Phila.
Springfield Facing Co.,
317 Main St., Springfield, Mass.
Stevens, Frederic B., Detroit, Mich.
U. S. Graphite Co., Saginaw, Mich.
Woodison, E. J., Co., Detroit, Mich.

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Dunning & Boschert Press Co., Inc., The,
328 West Water St., Syracuse, N. Y.
National Engineering Co., Machinery Hall Bldg.,
549 W. Washington St., Chicago, Ill.

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Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

FERRO ALLOYS
Primos Chemical Co., Primos, Pa.

FERRO CARBON-TITANIUM
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

FERRO-MANGANESE
Donner Steel Co., Inc., Abbott Road, Buffalo, N.Y.

FERRO-MOLYBDENUM
Primos Chemical Co., Primos, Pa.

FERRO-SILICON
Keokuk Electro-Metals Co.,
1518 Corn Exchange Bk. Bldg., Chicago, Ill.

FERRO-TITANIUM
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

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Combined Supply & Equipment Co.,
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Queen's Run Fire Brick Co., Lock Haven, Pa.
Stevens, Frederic B., Detroit, Mich.

FIRE SAND
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Diamond Clamp & Flask Co.,
38-40 N. 14th St., Richmond, Ind.
Sterling Wheelbarrow Co., 64th Ave., Milwaukee.
Truscon Steel Co., Detroit, Mich.

FLASKS (Custom Made)
Madison Pattern & Flask Works,
10108 Detroit Ave., Cleveland, O.

FLASKS (Snap)
Adams Co., The, 106 Iron St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Diamond Clamp & Flask Co.,
38-40 N. 14th St., Richmond, Ind.
Obermayer, S., Co., 2563 W. 18th St., Chicago.
Sterling Wheelbarrow Co., 64th Ave., Milwaukee.
Truscon Steel Co., Detroit, Mich.

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Paxson, J. W., Co., Philadelphia, Pa.

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Paxson, J. W., Co., Philadelphia, Pa.

FLUX (For Iron or Brass)
Paxson, J. W., Co., Philadelphia, Pa.

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Kawin, Charles C., Co., Chicago, Ill.

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Biehl Iron Works, The, Inc., Reading, Pa.
Booth Electric Furnace Co.,
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Chesapeake Iron Works, Baltimore, Md.
Combined Supply & Equipment Co.,
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Foundry Appliance Co., Newark, N. J.
Foundry Equipment Co., The,
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Holcroft & Co., Book Bldg., Detroit, Mich.
Mott Sand Blast Mfg. Co., Inc.,
8 Frost St., Brooklyn, N. Y.
National Engineering Co., Machinery Hall Bldg.,
549 W. Washington St., Chicago, Ill.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Pridmore, Henry E., Chicago, Ill.
Sly, W. W., Mfg. Co., 4700 Train Ave., Clevel'd.
Standard Sand & Machine Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Whiting Fdy. Equipment Co., Harvey, Ill.

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Federal Fdry. Supply Co., The, Cleveland, O.
Harris Brothers Co., Chicago, Ill.
McCormick, J. S., Co., Pittsburgh, Pa.
Scully-Jones & Co., Chicago, Ill.

FOUNDRY EQUIPMENT (Steel)
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Clearfield and Janney Sts., Philadelphia.

FOUNDRY GLOVES
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McLain's System, Inc.,
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A NATURAL FIRE BRICK

A Natural Fire Brick That Makes a Cheaper and Better Lining

It is cheaper, for the reason it is **placed directly** in the furnace in **lump form** as taken from the earth, instead of an artificial refractory, thereby lowering cost of production. It is better, for the reason the structure and analysis are correct, these conditions preventing expansion and contraction, and the fact that slag or clinker does not adhere to it. We can refer you to many up-to-date iron and steel firms in this country and Canada who are using our Mica Schist to line their cupolas, converters, soaking pits, mixers and other receptacles for which a refractory lining is required.

Fig. (1) Mica Schist Rough from Quarry.
Fig. (2) Mica Schist Ready for Use, Showing Grain of Stone and Side to Be Placed toward the Fire.

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Diamond Master Flask

The Diamond **"Master" Flask** eliminates the hardest work in your foundry—the shaking out and handling of heavy, cumbersome flasks.

Speedy, accurate and durable, the "Master" Flask will greatly increase your output and facilitate the order and efficiency of your molding floor

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Diamond Steel Bands eliminate runout troubles. They drop in the flask easily and ram out tight against the mold. Write for catalog.

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Kelly, T. P., & Co., Inc., 355 West 26th St., New York City.
Obermayer, S., Co., 2563 W. 18th St., Chicago.
Mott Sand Blast Mfg. Co., Inc., 8 Frost St., Brooklyn, N. Y.
National Engineering Co., Machinery Hall Bldg., 549 W. Washington St., Chicago, Ill.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Pettinos, Chas. E., 25 Church St., New York City.
Pettinos, George F., Real Estate Bldg., Phila.
Sly, W. W., Mfg. Co., 4700 Train Ave., Clevel'd.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Detroit, Mich.

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Quigley Furnace Specialties Co., 26 Cortlandt, N. Y.

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Dixon, Joseph, Crucible Co., Jersey City, N. J.

FURNACES
Booth Electric Furnace Co., 314 So. Dearborn St., Chicago, Ill.
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.
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Holcroft & Co., Book Bldg., Detroit, Mich.
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FURNACES (Annealing)
Booth Electric Furnace Co., 314 So. Dearborn St., Chicago, Ill.
Holcroft & Co., Book Bldg., Detroit, Mich.

FURNACES (Brass)
Booth Electric Furnace Co., 314 So. Dearborn St., Chicago, Ill.
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Hausfeld Co., The, Harrison, O.
Holcroft & Co., Book Bldg., Detroit, Mich.
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.
Stevens, Frederic B., Detroit, Mich.
Whiting Fdy. Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Detroit, Mich.

FURNACES (Brass Electric)
Booth Electric Furnace Co., 314 So. Dearborn St., Chicago, Ill.

FURNACES (Electric)
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Electric Furnace Co., Alliance, O.
Green Electric Furnace Co., 1602 Hoge Bldg., Seattle, Wash.
Greene Process Metal Co., Seattle, Wash.
Hoskins Mfg. Co., 453-71 Lawton Ave., Detroit.
Industrial Electric Furnace Co., Chicago.
Pittsburgh Electric Furnace Corp., Union Bank Bldg., Pittsburgh, Pa.
Pittsburgh Furnace Co., Inc., 215 Sycamore St., Milwaukee, Wis.
Price, T. W., Engrg. Co., Woolworth Bldg., New York City.
U. S. Smelting Furnace Co., Belleville, Ill.

FURNACES (Malleable Iron)
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Whiting Fdy. Equipment Co., Harvey, Ill.

FURNACES (Melting)
Booth Electric Furnace Co., 314 So. Dearborn St., Chicago, Ill.
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Hausfeld Co., The, Harrison, O.
Holcroft & Co., Book Bldg., Detroit, Mich.
Industrial Electric Furnace Co., Chicago, Ill.
McLain's System, Inc., 803 Goldsmith Bldg., Milwaukee, Wis.
Pittsburgh Electric Furnace Co p., Pittsburgh, Pa.
Price, T. W., Engrg. Co., Woolworth Bldg., New York City.

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Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.

FURNACES (Open Hearth)
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McLain's System, Inc., 803 Goldsmith Bldg., Milwaukee, Wis.

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Franklin Core Rod & Gagger Co., Buffalo and Third Sts., Franklin, Pa.

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Wadsworth Core Mch. & Equipment Co., Akron, O.

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GASES (Electrolytic)
Gas Products Association, 801 Marquette Bldg., Chicago, Ill.

GAS EXHAUSTERS (Rotary Positive Pressure)
P. H. & F. M. Roots Co., Connersville, Ind.

GAS PUMPS (Rotary Positive Pressure)
P. H. & F. M. Roots Co., Connersville, Ind.

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Adams Co., The, 106 Iron St., Dubuque, Iowa.

GEARS (Silent)
General Electric Co., Schenectady, N. Y.

GENERATORS (Oxy-Acetylene, Oxygen, Hydrogen)
Oxweld Acetylene Co., Newark, N. J.

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Strong-Kennard & Nutt Co., 2044 E. 9th St., Cleveland, O.

GLOVES (Sand Blast)
Hickory Steel Grip Glove Co., 2535 N. Schubert Ave., Chicago, Ill.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.

GLOVES (Steel Grip)
Hickory Steel Grip Glove Co., 2535 N. Schubert Ave., Chicago, Ill.

GLOVES (Workmen)
Hickory Steel Grip Glove Co., 2544 N. Maplewood Ave., Chicago, Ill.

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Strong-Kennard & Nutt Co., 2044 E. 9th St., Cleveland, O.

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Dixon, Joseph, Crucible Co., Jersey City, N. J.
Kelly, T. P., & Co., Inc., 355 W. 26th St., New York, N. Y.
Obermayer, S., Co., 2563 W. 18th St., Chicago.
Paxson, J. W., Co., Philadelphia, Pa.
Pettinos, Chas. E., 25 Church St., New York City.
Pettinos, George F., Real Estate Bldg., Phila.
United States Graphite Co., Saginaw, Mich.

GRAPHITE (Boiler and Lubricating)
Asbury Graphite Mills, Asbury, N. J.
Pettinos, Chas. E., 25 Church St., N. Y. C.
U. S. Graphite Co., Saginaw, Mich.

GREASES
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Swan & Finch Co., 165 Broadway, New York City.

GRINDERS (Electric)
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.

GRINDERS (Pneumatic)
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

GRINDERS (Pneumatic Portable)
Chicago Pneumatic Tool Co., 1037 Fisher Bldg., Chicago, Ill.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

GRINDING PANS
National Engineering Co., Machinery Hall Bldg., 549 W. Washington St., Chicago, Ill.

GRINDING WHEELS
MaxF Grinding Wheel Corp., Chester, Mass.

GRINDING WHEELS AND MACHINERY
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National Grinding Wheel C., Inc., 2982 Main St., Buffalo, N. Y.

GRINDING WHEEL PLATES (Steel)
Moltrup Steel Products Co., Beaver Falls, Pa.

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Mott Sand-Blast Mfg. Co., Inc., New York.
Chamber of Commerce Bldg., New Haven, Conn.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.

GRIT (Angular and Steel)
Globe Steel Co., Cleveland, O.
Harrison Bros., Inc., Amesbury, Mass.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.

GUNS (Spray)
Malleable Iron Fittings Co., Branford, Conn.

HAMMERS (Chipping and Riveting)
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

HAMMERS (Chipping and Riveting—Pneumatic)
Chicago Pneumatic Tool Co., 1037 Fisher Bldg., Chicago, Ill.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Oldham, Geo. & Son Co., Frankford, Philadelphia.

HAND PADS (Steel Grip)
Hickory Steel Grip Glove Co., 2535 N. Schubert Ave., Chicago, Ill.

HANGERS (Shaft)
Hyatt Roller Bearing Co., Metropolitan Tower, New York.

HEATING AND VENTILATING SYSTEMS
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

HELMETS (Sandblast)
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Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Strong-Kennard & Nutt Co., 2044 E. 9th St., Cleveland, O.

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U. S. Chaplet & Supply Co.., 140 Cedar, N.Y.C.

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Sellers, Wm., & Co., Inc., Philadelphia, Pa.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Toledo Bridge & Crane Co., Toledo, O.

HOISTS (Air)
Chicago Pneumatic Tool Co., 1078 Fisher Bldg., Chicago, Ill.
Northern Engineering Works, 4 Chene St., Detroit.
Ridgway, Craig, & Son, Coatesville, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

HOISTS (Electric)
Box, Alfred & Co., Inc., Philadelphia, Pa.
Link Belt Co., Chicago, Ill.
Northern Engineering Works, 4 Chene St., Detroit.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Fry. Equipment Co., Harvey, Ill.

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Chisholm-Moore Mfg. Co., Cleveland, O.
Whiting Fry. Equipment Co., Harvey, Ill.

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Ingersoll-Rand Co., 11 Broadway, New York City.

HOISTS (Skip)
Bartlett, C. O., & Snow Co., Cleveland, O.

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Chicago Pneumatic Tool Co., 1037 Fisher Bldg., Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

HOSE CLAMPS
Malleable Iron Fittings Co., Branford, Conn.

HOSE COUPLINGS (Universal)
Chicago Pneumatic Tool Co., 1037 Fisher Bldg., Chicago, Ill.

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Chicago Pneumatic Tool Co., 1037 Fisher Bldg., Chicago, Ill.
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Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.

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White & Brothers, N. Amer. Bldg., Philadelphia.

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Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.
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Woodison, E. J., Co., Detroit, Mich.

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Stevens, Frederic B., Detroit, Mich.
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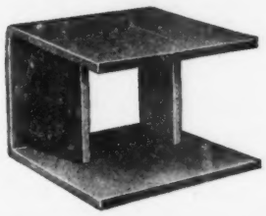

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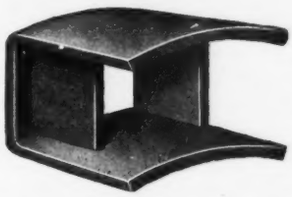

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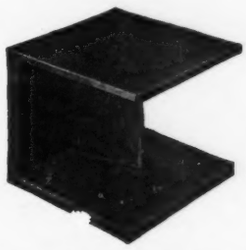

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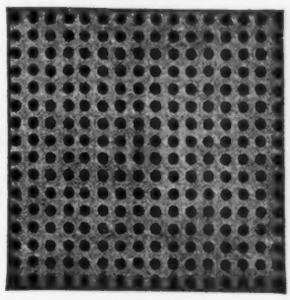

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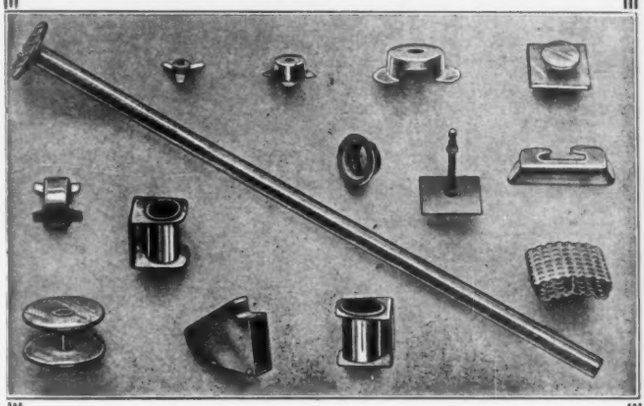

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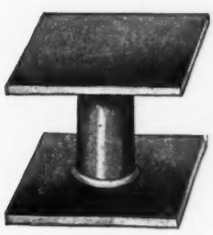

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Obermayer, S., Co., 2563 W. 18th St., Chicago.
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RODS—See WELDING RODS AND WIRE

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Pettinos, Chas. E., 25 Church St., N. Y. C.
Pettinos, George F., Real Estate Bldg., Phila.
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Gardner Governor Co., Foundry Dept., Quincy, Ill.
Hoevel Mfg. Corp.,
154 Ogden Ave., Jersey City, N. J.
Macleod Co., Bogen St., Cincinnati, O.
Mott Sand Blast Mfg. Co., Inc.,
8 Frost St., Brooklyn, N. Y.
Pangborn Corporation, P. O. Box 851,
Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Phoenix Machine Co., Inc.,
261 Broadway, New York.
Sly, W. W., Mfg. Co., 4700 Train Ave., Cleveland.
U. S. Silica Co., 419 Peoples Gas Bldg., Chicago.
Whiting Fdy. Equipment Co., Harvey, Ill.

SAND BLAST GLOVES
Hickory Steel Grip Glove Co.,
2535 Schubert Ave., Chicago, Ill.

SAND BLAST ABRASIVES, GRIT AND SHOT
Globe Steel Co., Cleveland, Ohio.
Harrison Supply Co., 5 and 7 Dorchester, Boston
Mott Sand Blast Mfg. Co., Inc.,
8 Frost St., Brooklyn, N. Y.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.

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Stodder, W. F., P. O. Box 747, Syracuse, N. Y.

SAND BLAST ROTARY TABLES
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SAND BLAST SAND
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Pettinos, Chas. E., 25 Church St., N. Y. C.
Pettinos, George F., Real Estate Bldg., Phila.
Portage Silica Co., Youngstown, O.
Tamms Silica Co.,
30 N. LaSalle St., Chicago, Ill.
U. S. Silica Co., 419 Peoples Gas Bldg., Chicago.

SAND BLAST SHOT (Steel)
Mott Sand Blast Mfg. Co., Inc.,
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SAND BLAST TUMBLING BARRELS—See TUMBLING BARRELS

SAND CONVEYING AND HANDLING MACHINERY
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Link-Belt Company, Chicago, Ill.
National Engineering Co., Machinery Hall Bldg.,
549 W. Washington St., Chicago, Ill.
Standard Sand & Machine Co., Cleveland, O.

SAND CUTTING MACHINERY
American Foundry Equipment Co.,
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Wadsworth Sand Cutting Corp.,
316 Sloan Bldg., Cleveland, O.

SAND DRYERS
Bartlett, C. O., & Snow Co., Cleveland, O.
Macleod Co., Bogen St., Cincinnati, O.
Pangborn Corporation, P. O. Box 851,
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SAND HANDLING EQUIPMENT
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SAND MIXING MACHINERY
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National Engineering Co., Machy. Hall Bldg.,
549 W. Washington St., Chicago, Ill.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.
Standard Sand & Machine Co., Cleveland, O.
Vulcan Engrg. Sales Co., Chicago, Ill.
Wadsworth Core Mch. & Equipment Co., Akron, O.
Wadsworth Sand Cutting Corp.,
316 Sloan Bldg., Cleveland, O.

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Chicago Pneumatic Tool Co.,
1037 Fisher Bldg., Chicago, Ill.
Independent Pneumatic Tool Co.,
600 West Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Oldham, Geo., & Son Co., Frankford, Philadelphia.

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National Engineering Co., Machinery Hall Bldg.,
549 W. Washington St., Chicago, Ill.

SAND SCREENS
Audubon Wire Cloth Co., Audubon, N. J.

SAND SIFTERS
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American Foundry Equipment Co.,
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Arcade Mfg. Co., Dept. D, Freeport, Ill.
Herman Pneumatic Machine Co.,
Union Bank Bldg., Pittsburgh, Pa.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Kelly, T. P., & Co., Inc.
355 West 26th St., New York, N. Y.
Mott Sand Blast Mfg. Co., Inc.,
8 Frost St., Brooklyn, N. Y.
National Engineering Co., Machinery Hall Bldg.,
549 W. Washington St., Chicago, Ill.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Standard Sand & Machine Co., Cleveland, O.

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Clearfield and Janney Sts., Philadelphia, Pa.
Truscon Steel Co., Detroit, Mich.

SASH (Steel Continuous)
Lupton's, David, Sons Co.,
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Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

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New Haven Sand Blast Co.,
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Pangborn Corp., P. O. Box 851, Hagerstown, Md.

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Strong-Kennard & Nutt Co.,
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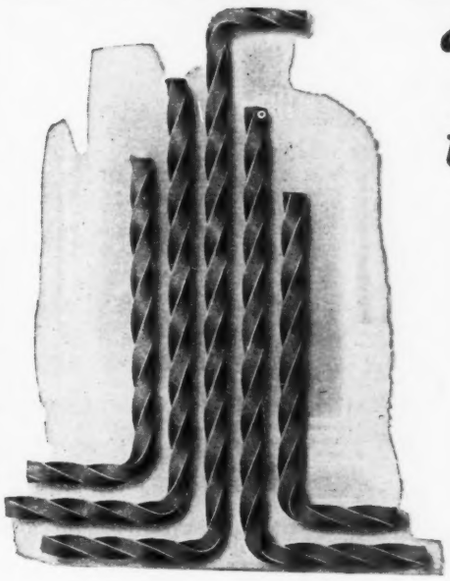

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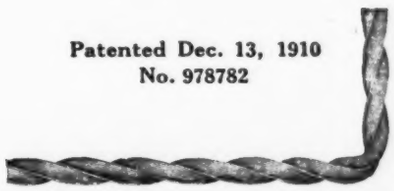

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Pettinos, George F., Real Estate Bldg., Phila.
Stevens, Frederic B., Detroit, Mich.

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Keller Pneumatic Tool Co., Grand Haven, Mich.
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TRACKS (Portable)
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TURBO BLOWERS—See BLOWERS

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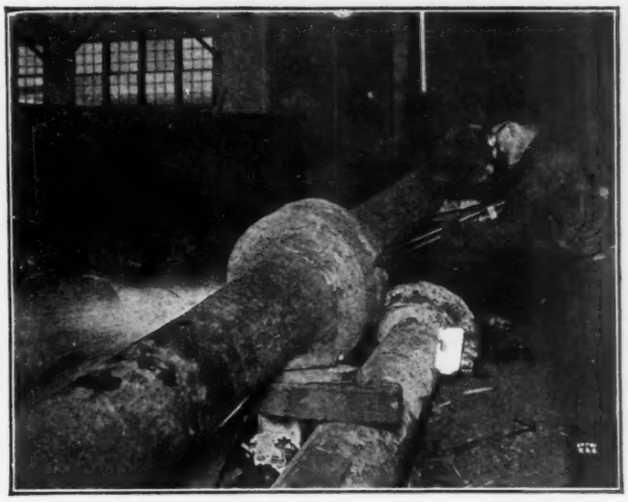

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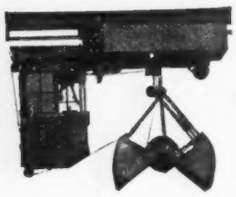

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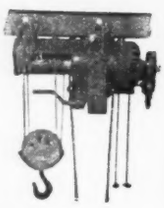

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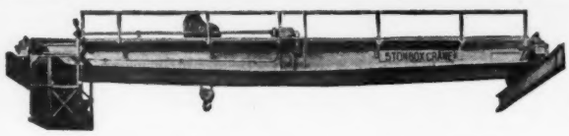

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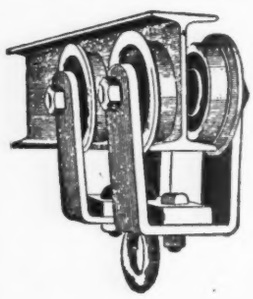

OVERHEAD TRACKING AND EQUIPMENT

For Foundries and Factories, Roller Bearing Trolleys, Switches, Hoists, Dump Buckets, etc.

Randall Tramrail Company
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ELECTRIC CRANE & HOIST CO.
Literature or Service on request
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Electric or Hand Power
L. A. GREEN, Sales Agt.
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"The Most Rugged Crane Built"
CHESAPEAKE CRANES

IN the three essential units of a crane—mechanical, electrical and structural—where great strength, ruggedness and rigidity are demanded, Chesapeake Cranes have provided generous strength factors. Because of their unfailing dependability in standing up under the most gruelling service,
Chesapeake Iron Works

Chesapeake Cranes are known as *"The Most Rugged Crane Built."*
We solicit inquiries for prospective crane installations. Write for literature.
Unusual facilities for early deliveries.
Baltimore, Maryland

BIEHL EQUIPMENT

The *Biehl "V" Dump Car* illustrated here has met with unusual success in foundries, steel mills, mines and railroad yards.

Built for operation on tracks or on ground.

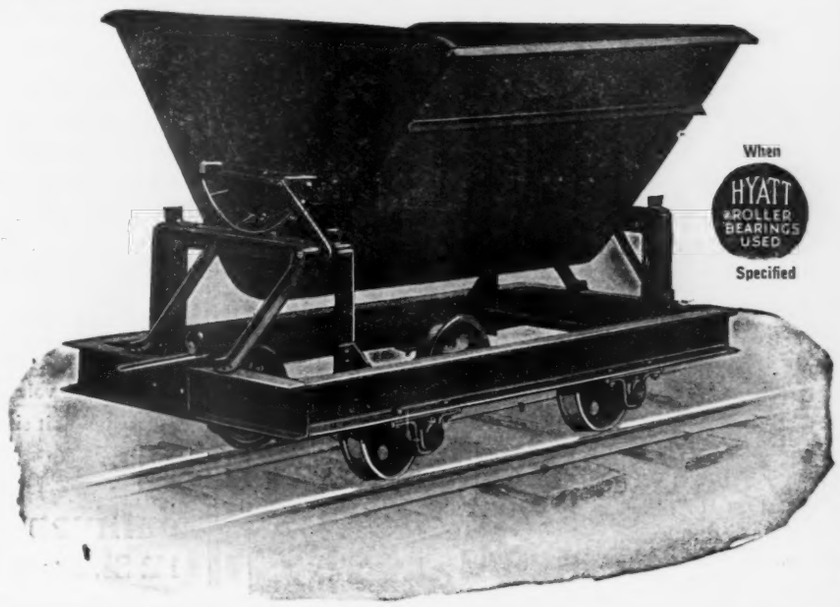
for Service

Side Dump Cars
Foundry Cars
Core Ovens
Charging Barrows
Dump Buckets
Skip Barrows
Coal Barrows
Smelter Barrows

Write for Catalog

We are specialists in the manufacture of Car Wheels.

The Biehl Iron Works
Reading, Pa.



Ingersoll-Rand small compressors provide air power at low cost, not only on paper but in your shop. The little extra refinements in design and manufacture, about which we have been telling you in our advertising, say nothing but save much in actual compressor operation.

If you are looking for true economy in the production of 50 to 1000 cu. ft. of air, you will desire the opportunity of studying the I-R small machines.

Shall we send you the Bulletins?

Ask for Nos. 3230 and 3131.

INGERSOLL-RAND COMPANY

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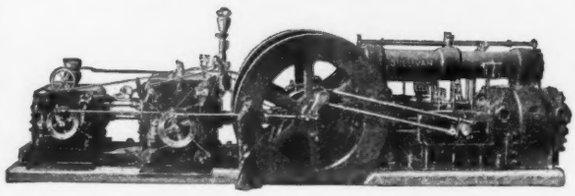
DOMESTIC OFFICES — FOREIGN OFFICES

APPLY TO NEAREST OFFICE

423-C

Cheaper Air Power



SELECT YOUR AIR COMPRESSOR on the basis of running cost per foot of air compressed rather than purchase price. A high efficiency compressor will soon save the difference in initial cost as compared with one of lower price, but greater fuel or power consumption.

Sullivan Corliss Air Compressors

secure high duty by the use of tandem compound steam cylinders, both equipped with full Corliss valve gear.

Tandem two-stage air cylinders, with large intercooling area, provide high volumetric and compression efficiencies.

Stocked in unit sizes from 1000 to 3150 ft.

Bulletin 1875F

Sullivan Machinery Company
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Removes Water from Compressed Air!

Stratton Air Separator

Send for Bulletin No. 1111

The Griscom-Russell Co. 2118 West St. Building New York

DO You Use AIR ?

NORWALK
AIR & GAS · COMPRESSORS

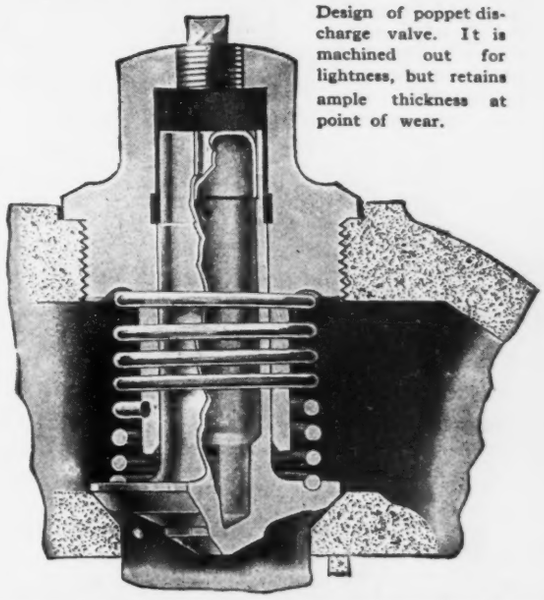
Distinctive Features that Add to Norwalk Compressor Efficiency

6--Discharge Valve

By painstaking design both light weight and double thickness at wearing surfaces have been obtained. Abundant area is allowed for the passage of air or gas around and through the valves. All cushioning consistent with rapid, efficient action is provided.

One feature is worth careful note. The valves are placed in the *cylinder heads*. Thus the shortest possible post and least dead space is obtained. This also allows the water jacket on the gas cylinder to keep maximum length.

Bulletins on Air, Oxygen, Hydrogen. Acetylene and Carbonic Acid Gas are ready to mail. *Tell us where to address your copies.*



Design of poppet discharge valve. It is machined out for lightness, but retains ample thickness at point of wear.

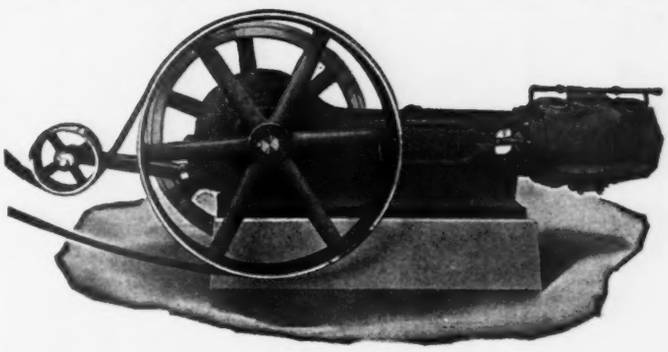
THE NORWALK IRON WORKS COMPANY
Pioneer Builders of Compressors
South Norwalk, Conn.

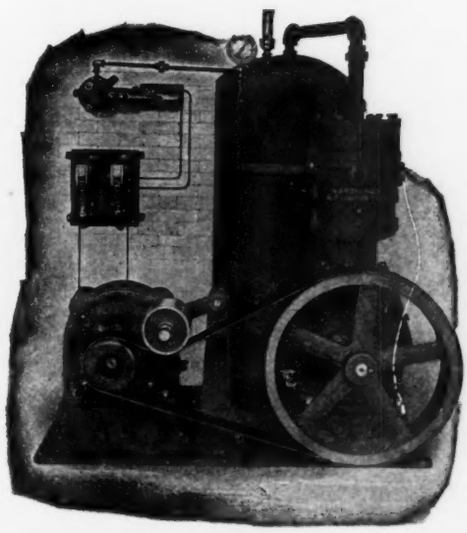
ANY·CAPACITY **ANY·PRESSURE**

THE GARDNER LINE AIR COMPRESSORS

Result of Half Century Manufacturing Experience

Even "Air" can be made to Earn Profits—in Foundry Work—providing you install the ***Right*** *Compressor.*





The Gardner *Is Right*

It is especially adapted for foundry use.
They are made to meet every demand and do it economically.
Large assortment of types and sizes. Prompt deliveries.

The Gardner Governor Co.

Foundry Dept. **QUINCY, ILLS.**

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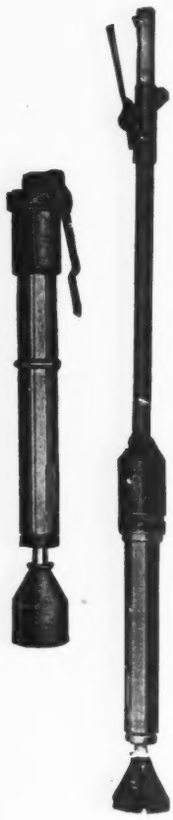
Rix Compressed Air & Drill Co., Los Angeles, Calif.	409 East 3rd Street
Rix Compressed Air & Drill Co., San Francisco, Calif.	505 Howard Street

Thor

RAMMERS



Wonderful time savers for either bench or floor molders.

Insure greater uniformity in the weight of castings and eliminate straining in the mold.

Let us send you a *Thor Rammer* on trial.

We also manufacture the Thor Chipping Hammers and Thor Portable Grinders.

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INDEPENDENT PNEUMATIC TOOL COMPANY

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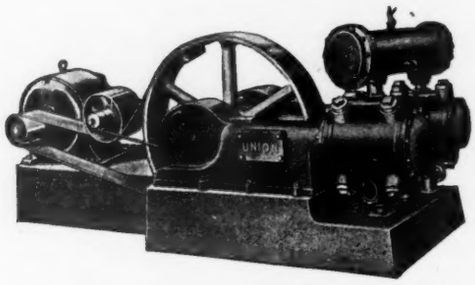
UNION

AIR COMPRESSORS

If you want a Dependable and Economical Unit for the Foundry or Machine Shop install a Union Class "D" Air Compressor.

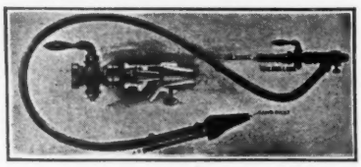
We can furnish you this type either belt or steam driven in any capacity up to 1200 cubic feet.

Send us your requirements



Union Steam Pump Co.
Battle Creek, Mich.
U. S. A.

THE CYCLONE
Suction Sand Blast Nozzle
A Complete Sand Blast For Cleaning
IRON, STEEL AND BRASS CASTINGS



This Outfit is Guaranteed to Give Satisfaction
No Sand Tank to Fill. Work Can be Stopped at the Nozzle
Write for Circular and Price

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EDGAR E. BROSIUS, PITTSBURGH, PA.

SANDBLAST MACHINES of EVERY DESCRIPTION
PHOENIX MACHINE COMPANY, Inc.
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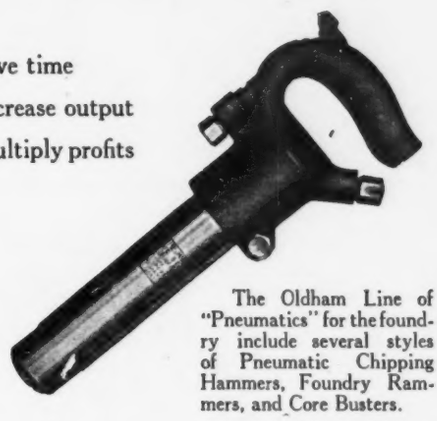
PNEUMATIC TOOLS

for Economical Service

—save time
—increase output
—multiply profits



The Oldham Line of "Pneumatics" for the foundry include several styles of Pneumatic Chipping Hammers, Foundry Rammers, and Core Busters.

Write for prices.

GEORGE OLDHAM & SON COMPANY
Frankford, Philadelphia, Pa.

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KELLER

KELLER-MADE

HOW ABOUT TIME YOUR MEN LOSE WAITING FOR REPAIRS?

THE individual workman is not to blame for the time lost while waiting for repairs on inferior tools. The foreman is not to blame for the occasional decrease in his output when he is denied first-grade equipment.

KELLER-MADE MASTER-BUILT PNEUMATIC TOOLS save time for the workman, increase output for the foreman and cut down expense generally by converting non-productive time into productive labor. There's a KELLER-MASTER TOOL for every purpose—and every KELLER-MASTER TOOL is the best for the purpose. Write our nearest branch office for particulars.

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MASTER-BUILT

Cleveland AIR TOOLS

Foundry Chipping Hammers
Made in sizes to suit all classes of work

Foundry Sand Rammers
Floor, Flask and Bench
Made in sizes to suit all classes of work

Portable Emery Grinders
For Cleaning Castings, Etc.

Bowes Air Hose Couplings
Standard Equipment Everywhere

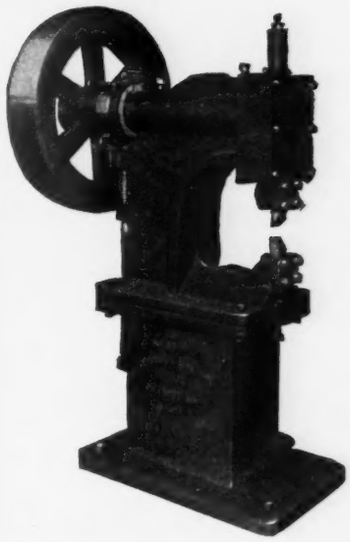
Instantly connected or disconnected and air tight under all pressures

AIR TIGHT

Above cut shows the Cleco Never Slip Clamps attached to Bowes Air Hose Couplings

WRITE FOR ILLUSTRATED BULLETINS Nos. 41 and 42

The Cleveland Pneumatic Tool Co.
General Offices and Works
CLEVELAND, OHIO
New York, Pittsburgh, Detroit, Chicago, Toronto, Boston, St. Louis, Philadelphia, San Francisco
John MacDonald & Company, Pollokshaws, Glasgow, Scotland



SPRUE CUTTERS

FLASK CLAMPS

BLOW VALVES

VIBRATORS

KNEE VALVES

SAND RIDDLES

FOUNDRY MACHINERY and EQUIPMENT

MANUFACTURED BY THE

Tessmer Machine & Tool Co.
285-291 Rivard Street
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Descriptive Matter Upon Request

RESULTS

IF you are discouraged with the RESULTS obtained from the GRINDING WHEELS you have been using, or, if you are anxious to increase your output, just drop us a line giving the following information:

- Dimensions of the wheels required
- Kind of metal you are grinding
- Large or small castings
- Hand grinding or automatic machines
- Thickness of metal to be removed
- Quantity of wheels required

NATIONAL GRINDING WHEEL COMPANY, Inc.

2982 Main Street, Buffalo, N. Y., U. S. A.

Manufacturers of

"The Wheel That Talks for Itself"

NATIONAL GRINDING WHEEL COMPANY, INC.

The Most Modern and Up-to-Date

SAND BLAST EQUIPMENT

Consisting of

HOSE MACHINES
DUSTLESS SAND BLAST TABLES
SAND BLAST BARRELS
DUST ARRESTERS
EXHAUST FANS

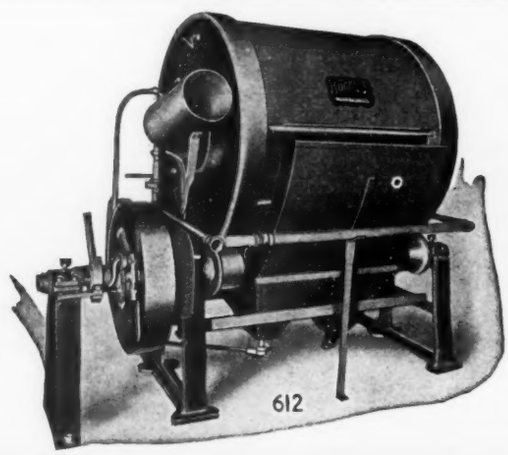
When next in the market for Sand Blast Hose try the

DOELCAM
Sand Blast Hose

Specially made for severe work.

THE MACLEOD CO.

Bogen St.
Cincinnati, Ohio, U. S. A.



DAYTON
GRINDING WHEELS

There's one adapted to your particular use

Just a word from you regarding the class or nature of the work you wish to grind, and we will select a "Dayton" which will exactly suit your needs.

Many of the largest foundries in the country are numbered among Dayton Grinding Wheel users.

Write for prices

DAYTON GRINDING WHEEL CO.
DAYTON, OHIO

HENDERSON

Tumbling Barrels are the result of nearly forty years experience in this line. This firm was the pioneer in the tumbling barrel field, and has always been in the lead in making improvements.

Another point in our favor is that our one and only line is tumbling barrel manufacture thus we are able to give our customers the products of specialists.

Our line embraces Foundry Barrels - (that is barrels especially adapted to iron and brass foundries) Wet Grinding, Tilting Oblique, Japan, and Burnishing. We also make several special types. If it's a tumbling barrel consult us.

THE HENDERSON BROS. COMPANY
Waterbury, Conn., U. S. A.

PRECISION PATTERNS

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MADISON MADE

Service Accuracy

Immediate Delivery

Prompt deliveries of accurately made patterns mean no delays in your production plans. A skilled and expert pattern maker devotes his entire time to following the progress of your work while it is in our shop and to checking the finished patterns thoroughly before they are delivered. This feature of *Madison Made Precision Patterns* insures the production of accurate patterns within the minimum length of time.

The Madison Pattern & Flask Works

10108 Detroit Avenue

Cleveland U. S. A.

Hard Iron Tumbling Stars

Made of a Special Grade of Hard Iron. Durable and Effective Cleaners.

The Tanner Mfg Co.

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99 8/10 Pure Silica

SAND BLAST SAND

Coarsest Hardest

SILICA FLOUR 140 to 200 Mesh Standard Grades

BUY DIRECT *at Lowest Prices*

SILICA FLOUR 350 Mesh For Special Work

TAMMS SILICA CO.

CHICAGO, ILL.

Mines and Mills

Tamms, Ill. Ottawa, Ill.

For Patterns and Flasks

Kiln Dried

Mahogany and Cork Pine

ESTABLISHED 1865

J. P. Scranton and Company

Detroit, Mich.

THOMPSON'S

MAHOGANY PATTERN LUMBER Established 1843

Mahogany is used in preference to any other wood by many leading foundrymen because it will not Shrink, Warp or Twist.

Samples and prices furnished on request

LEWIS THOMPSON & CO., Inc.

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MAHOGANY PATTERN LUMBER

MAHOGANY FOR PATTERNS

SPECIAL PATTERN GRADE Prices No Higher Than Good White Pine

ICHABOD T. WILLIAMS & SONS

220-11th Ave. NEW YORK, N. Y.

THE IDEAL WOOD FOR THIS PURPOSE

ONE HUNDRED TIMES MORE EFFICIENT!

GRITBLAST your castings

Our Metal Abrasives are a hundred times more efficient than sand. Their ability to withstand the force of impact without crumbling to dust makes them much more **economical** than sand—because one ton will do as much work as from eighty to one hundred tons of sand.

HARRISON'S DIAMOND GRIT or CHILLED SHOT

—clean quicker, cleaner and with less expense.
—less wear on hose nozzles.
—do away with sand dryers.

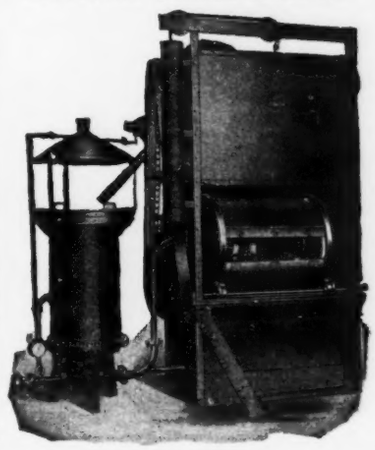
Write for samples.

HARRISON SUPPLY CO.

5 and 7 Dorchester Ave. Extension

BOSTON, MASS. U. S. A.

REVOLVING BARREL MACHINE



Barrel revolves *slowly*, thereby turning the pieces over. Cleaning done by sandblast only, not by tumbling.

DUSTLESS SELF-CONTAINED

HOEVEL SANDBLAST AUTOMATIC MACHINES

do not let even the finest dust escape. Your workmen can perform their duties with the greatest efficiency and without danger to their health. The "Hoevel" requires but a very small space, is simple in design, has a small power consumption, and automatically screens the sand.

Greatest Output at Lowest Cost

***Result* Producing Sandblast Machinery**

Economy Efficiency

Capacity *not* Cheapness

ROTARY TABLE MACHINE

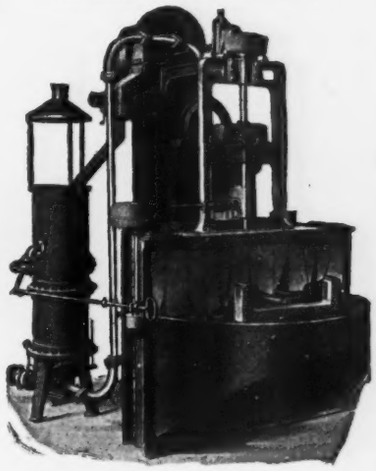


Table rotates continuously at slow speed. Even distribution of sandblast all over surface by means of rotating nozzles.

Every kind of Sandblast Equipment, Dustless Sandblast Rooms, Hose Sandblasts, etc.

HOEVEL Manufacturing Corporation

Controlled by L. O. KOVEN & BRO.

154 Ogden Avenue Jersey City, N. J.

Cleveland Office: 503 American Trust Building

William Sellers & Co. Incorp.

PHILADELPHIA, PA.

For disintegrating lumpy sand, and for thoroughly and evenly mixing all kinds of molding sand, core sand and foundry mixtures **use the Sellers Sand Mixer.** It does the work rapidly, effectually and at a surprising saving in cost. Its capacity is limited only by the facilities for conveying the sand to and from it. **Belt or motor driven.** Cut shows motor drive.

The "Shuster"

A shovel that always pleases. Made by a firm that desires above all else to please!

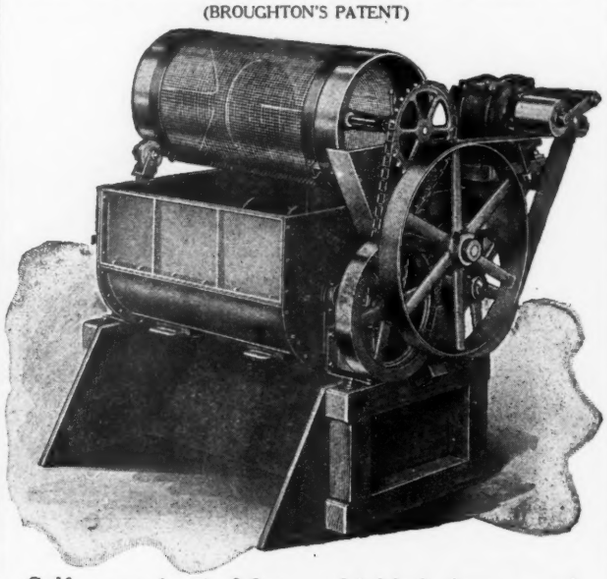
The Pittsburgh Shovel Co.
Oliver Building Pittsburgh Pa.

The "Shuster" Shovel s built especial'y to withstand rough usage—an ideal molder's shovel. Made with extra heavy blade, perfectly shaped handle and balanced to a nicety.

All we want is your order for a trial dozen. Our business has been built up from repeat business started in this small way. We are certain you will be pleased with the first dozen.

Sand Mixer

(BROUGHTON'S PATENT)



Self contained, Motor shielded from sand. Double paddle shafts insure quick and complete mixture and saving in oil or other binder. Quick discharge. With or without screen.

Let us tell you more about them.

DUNNING & BOSCHERT PRESS CO., Inc.

Established 1872 No. 328 West Water St. SYRACUSE, N. Y.

PRODUCERS OF

High Grade Molding Sand

Send us your inquiries

PEERLESS SAND CO.

PITTSBURGH, PA.

Oliver Bldg. Grant 1774

(Plant at Cheswick, Pa.)

SHELLAC

Avoid paying exorbitant prices for Shellac by using our ***Economy Pattern-lac*** at 75c per pound.

Send for trial order on approval or sample to test in your own pattern shop.

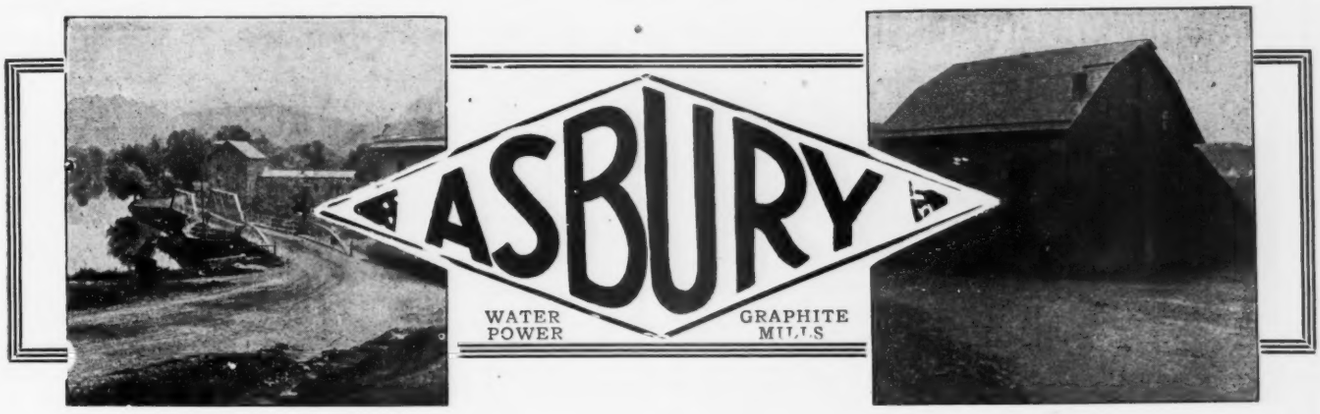
The Brodin Pattern & Supply Co.
2420 W. 16th St., CHICAGO, ILL.

1920

The spirit of Christmas prompts us to extend to our friends and customers our Best Wishes for a Merry Christmas and Cordial Greeting for a New Year of Prosperity.

United Compound Company

Buffalo, N. Y.



ASBURY

East India
SILVER LEAD
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FLAKE GRAPHITE
BOILER GRAPHITE

Ground by a power that is never affected by fuel shortage

The Asbury Graphite Mills never close down from the lack of power.
In water power, nature has provided a never failing source of energy, unaffected by labor shortage, transportation difficulties or high priced fuel. The continuous roar of the great water wheels of the Asbury Mills may be heard, day in and day out, year after year, insuring uninterrupted production.
The Economic feature of this power is reflected in the price and quality of Asbury products.
The Asbury Mills never grind an adulterated or mixed facing.
Let us send you samples of Asbury Products.

The Asbury Graphite Mills

Asbury, Warren Co. - NEW JERSEY

Model 100

KING ARKWELD HELMET

The lightest and most practical Helmet for heavy welding.

Fitted with Arkweld lenses.

Standard in many plants.

Send for our new booklet

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The sole object of our entire plant is to make

"Philadelphia" Chaplets

We are specialists in designing and making CHAPLETS, and we make the best. If required style of CHAPLET is not carried in stock any style will be made. No CHAPLET too small or no CHAPLET too large. There is unquestionably a growing demand for higher grade CHAPLETS in the foundry world. We enjoy a reputation for this class of CHAPLETS and our customers tell us that it is merited;—they cost a little more, but they are worth it.

The Philadelphia Chaplet & Mfg. Co.
Philadelphia, Pa.

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WELDING AND CUTTING APPARATUS

CALCIUM CARBIDE
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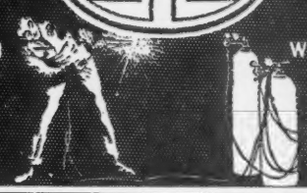

DIAMOND
CORE OIL
—assures *quick baking* and *easily cleaned castings, prevents smoke or gas, eliminates blow holes and scabs.*
DIAMOND OIL COMPANY, Inc., PHILADELPHIA, PA.
Offices, Land Title Building — Works: 52nd and Grays Avenue

RED HEAD
CORE OILS
Specially compounded, having a PURE LINSEED OIL base.
We stand behind our "STERLING" products with our guarantee to satisfy you.
STERLING OIL CORPORATION
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Carbide Lights and Oxy-Acetylene Cutting and Welding Torches and Apparatus
THE ALEXANDER MILBURN COMPANY-BALTIMORE, MD

MOLDING SANDS
Just a little better than the sands you thought were best
THE SUPERIOR SAND CO.
CLEVELAND, OHIO

The Injector Sand Blast
For Cleaning All Castings
Made by J. M. BETTON
59 Pearl Street NEW YORK
Write for "Sandcraft"

WE MANUFACTURE
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MONOGRAMS, ETC.
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DUQUESNE PATTERN CO.
39 and 40 Water St., PITTSBURGH, PA.

32 Standard Patented Core Ovens in the Modern Plant of the Saginaw Products Company

HOLCROFT CORE OVENS ALWAYS IN THE VANGUARD

Wideawake management and foundry engineers specify our patented Core Ovens. They are considered indispensable in the well ordered and up-to-date core room. Holcroft ovens are always a revelation when seen in operation the first time. Scores of the largest foundries have adopted them exclusively and regular repeat orders for ever increasing production is eloquent evidence of highest satisfaction.

For maximum production and economy, for perfectly baked cores and small core losses, for speed, ease and evenness of temperature control, for fine working mechanism and building construction, simplicity of operation and all-around satisfaction, Holcroft ovens stand without competition. With our wonderful battleship firebox for coke firing and patented heat control, fuel cost is almost negligible when compared with old type ovens.

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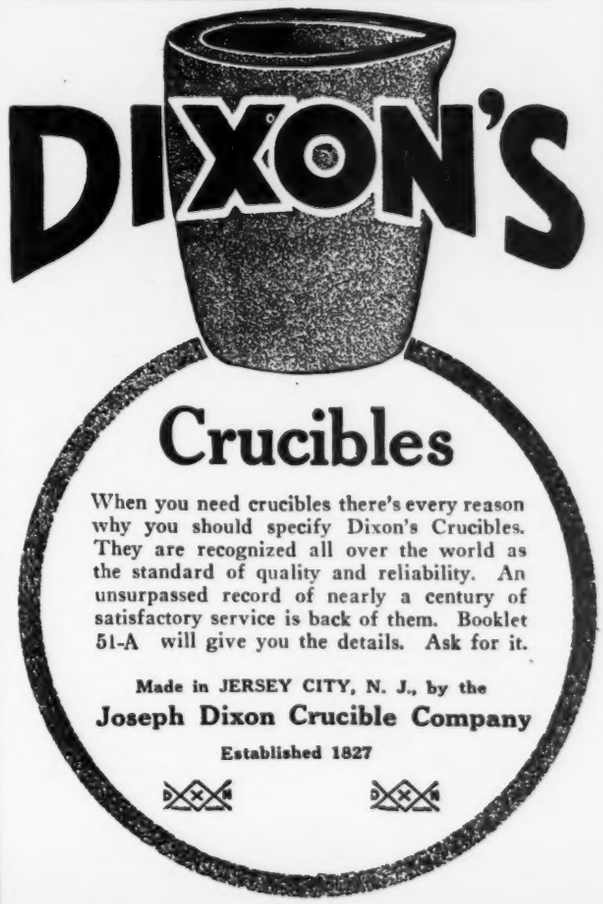

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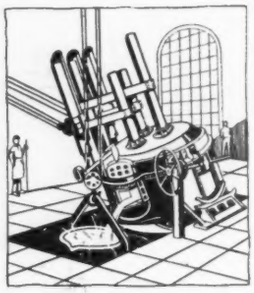

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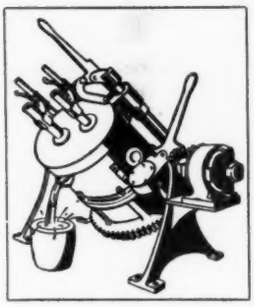
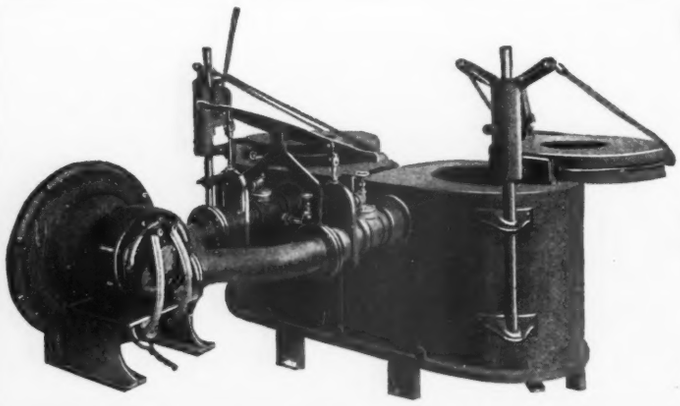


Moore Brass Furnace



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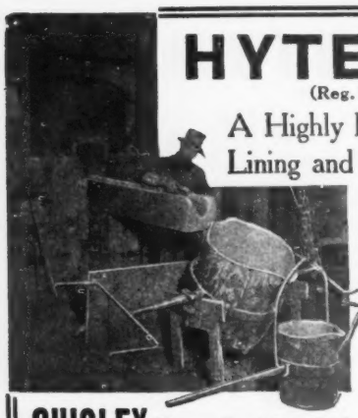

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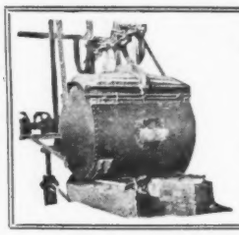

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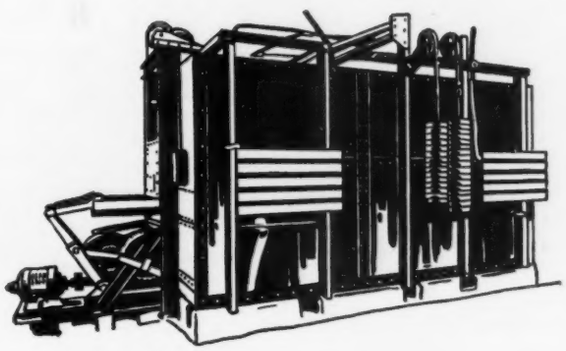

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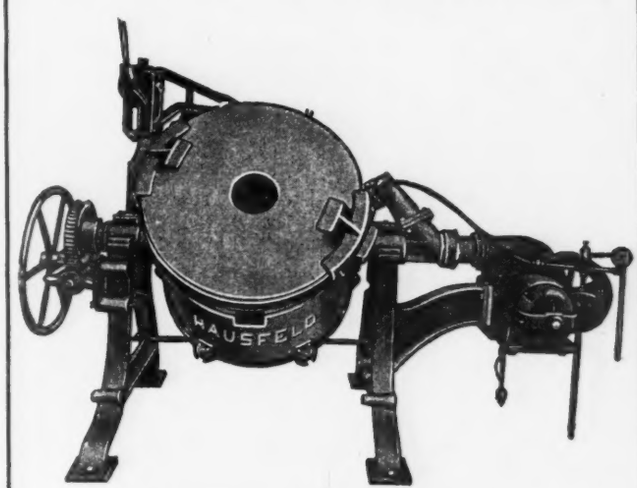

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Seven (7) words must be added for box address.

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WANTED:—AN A-1 ELECTRIC STEEL FURNACE man. One who can take entire charge of furnace and handle to best possible advantage. This position has future for man who is not an experiment. Write full particulars with present employer in first letter. Address Box 108, THE FOUNDRY, Cleveland, O.

STEEL FOUNDRY SUPERINTENDENT WANTED

One who has proven ability to produce high grade small and medium weight steel castings economically and conduct an orderly, smooth running shop. Must be practical molder and coremaker and up to date on modern methods, systematic working knowledge of Electric and Converter Carbon and Alloy Steel Castings; also annealing. Must know how to make and arrange wood and metal patterns for best production and capable of taking responsibility for all operations.

No Labor Troubles of any kind.

No attention given applications except as containing full statement of experience and salary expected. All replies confidential.

We want a man of proven ability as a producer and organizer.

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WANTED:—CORE ROOM FOREMAN, A NO. 1 man for general cores; also six Non-Union molders, to work in open shop. Address Ed Hayes, 32nd St., College Hill, Beaver Falls, Pa.

MOLDERS:—FIRST CLASS FLOOR FOR MACHINE and furnaces; steady work; no trouble; high wages. Box A A, Wellston, Ohio.

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"Malleable iron foreman, capable of handling a small Iron plant. We want a man that understands all parts of a Malleable Iron Foundry, also capable of superintending the erection of a small plant, including furnaces and ovens. State your qualifications in first letter, also state salary expected and how soon you could start. Don't write unless you know the business. Address Box 577, Joplin, Mo.

WANTED:—FLOOR, SIDE FLOOR, BENCH, Squeeze, and Machine Molders, by one of the leading Foundries of New England, well equipped, good wages, and steady work, conditions satisfactory. State experience, age and give references. Only high class men need apply. Address Box 173, THE FOUNDRY, Cleveland, O.

WANTED:—A FIRST CLASS CUPOLA MAN, steady work, good wages. Apply: Crescent Foundry Co., Rochester, N. Y.

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WANTED:—FIRST CLASS MOLDERS UNDER 30. Energetic Molders who desire to advance in the business are offered a good opportunity as Assistant Foundry Foremen in a leading Automobile Castings Foundry of 200 tons capacity. Knowledge of mixing and melting or experience in automobile work not necessary. State age, experience and salary wanted in first letter. Address Box 185, THE FOUNDRY, Cleveland, O.

WANTED:—CORE-ROOM FOREMAN CAPABLE OF taking charge of Department numbering 50 men; in one of largest grey iron shops in middle west. References required. Address Box 153, THE FOUNDRY, Cleveland, O.

WANTED:—FOREMAN FOR A FOUNDRY IN A good Ohio town, employing about 25 bench, floor and machine molders and melting about 10 tons of white and gray iron daily. An excellent opportunity for a competent man to make a future for himself. In replying give references, age and complete details as to past experience and salary wanted. Address Box 188, THE FOUNDRY, Cleveland, O.

Help Wanted

WANTED:—EXPERIENCED MALLEABLE MOLDING foreman capable of instructing new men and reducing molding losses. State experience in full, age and salary desired. Address Box 936, THE FOUNDRY, Cleveland, O.

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Wanted:—Superintendent for Foundry Department of one of the largest foundries in the U. S. making Automobile Castings exclusively.

Must be a man of wide experience in this particular branch of the foundry business, and capable of handling the intricate detail of this class of work. He must be willing to be active on the jobs and KNOW them. He must be a man who prefers action to alibis. He will be supported by a corps of competent foremen, and backed to the limit by an enthusiastic office executive force. The best man in the country need not hesitate to apply for this position. State age, experience and salary expected. This may be the chance of a life-time for some assistant who is now really running the "big man's" job for him. Communications will be held in strict confidence.

Address Box 168,
THE FOUNDRY, Cleveland, O.

APPLICATIONS DESIRED FROM TECHNICAL MEN to train for executive and sales positions by large molding machine manufacturer. Knowledge of foundry practice and pattern making desirable. Address Box 132, THE FOUNDRY, Cleveland, O.

WANTED

Large concern located in central west operating a modern gray iron and semisteel foundry desires to employ a competent superintendent who has demonstrated ability to produce high grade castings economically and conduct a harmonious shop. Must have been in charge of shop, a practical molder, and coremaker, also familiar with the rigging and operation of molding machines. Must understand thoroughly cupola practice, mixing and making semi-steel. Must produce miscellaneous castings from ounces to ten tons each and understand pattern equipment.

This position is open to an alert, foresighted, experienced man competent as a mechanic and manager of men who is willing to co-operate with the management to put the foundry on an efficient, economical productive basis.

Applications should contain a complete statement of experience present connections and salary expected.

All replies confidential and no reference communications with your authority. Address Box 155, THE FOUNDRY, Cleveland, O.

SUPERINTENDENT WANTED WITH PRACTICAL experience for Stove and Steel Range Factory, chance for advancement as business develops. Salary to start with must be moderate as business at present only employs about seventy-five hands. Beach Foundry Company, Limited, Ottawa, Canada.

WANTED

INSTRUCTORS—Two high grade non-union molders to act as instructors for inexperienced floor and bench molders in Cincinnati, Ohio. Permanent position with opportunity for advancement to foremen. Shop conditions the best. Address Box 134, THE FOUNDRY, Cleveland, O.

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MOLDING FOREMAN WANTED:—AN EXPERT molder on gray iron, light and medium work, floor and machine, who understands thoroughly molding practice and time required to put up various molds, sands and equipment, including molding machine work. Need not be experienced at all in cupola practice. Location two hundred miles from Chicago. Long established concern that operates every day in the year, in the most modern foundry with best working conditions and best environments. Useless to apply unless you are a thorough molder, foresighted and competent as a production man and manager of men. Write with detailed experience, references and wage wanted. Address Box 174, THE FOUNDRY, Cleveland, O.

WANTED:—GOOD ALL AROUND GRAY IRON molders experienced on light and medium weight castings, new modern foundry in Central Illinois. Work every day in the year. No labor trouble. Fine environments. Highest wages. Write with full particulars regarding experience, where now employed with references. Address Box 175, THE FOUNDRY, Cleveland, O.

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Wanted for Agricultural Implement plant located in Northern Indiana.

Must be live wire with demonstrated ability to produce economically.

Must be practical molder and core maker, understanding cupola and foundry practice.

No attention given applications without statement of experience and salary expected.

Replies confidential.

Address Box 176, THE FOUNDRY, Cleveland, O.

WANTED:—FOUNDRY FOREMAN FOR CONVERTER Steel Foundry. Man familiar with all details of Converter Foundry Practice. Address Box 177, THE FOUNDRY, Cleveland, O.

WANTED:—HIGH GRADE FOUNDRY FOREMAN to take charge of shop employing thirty to forty molders. Prefer one who can develop jarr rollover molding machines. State experience and former employers. Address P. O. Box 1564, Atlanta, Georgia.

WANTED:—FOUNDRY FOREMAN WHO IS FA- miliar with boiler and furnace work, for middle west shop. Man who has had experience with machines preferred. Excellent opportunity for the right man. Address Box 184, THE FOUNDRY, Cleveland, O.

WANTED:—HIGH GRADE FOUNDRY EXECUTIVE. One who can handle proposition from pig iron in its raw stage to the finished product, for foundry in Northern Ohio. Concern has large business and is well equipped. It presents a most splendid opportunity for a live wire, who is not afraid of work and will sacrifice when necessary. What we want is a result getter, one who realizes every day has twenty-four hours. We have the price for such a man. Address Box 130. THE FOUNDRY, Cleveland, O.

WANTED:—MECHANICAL ENGINEERING GRADU- ate with successful practical experience in foundry and machine shop. To have supervision of shop instruction and to teach machine shop and foundry classes, also industrial engineering classes. Position: Assistant Professor in southern engineering college. Salary: $1800. Session: About nine months. Position now open. Address Box 131, THE FOUNDRY, Cleveland, O

WANTED:—ALL AROUND FOUNDRYMAN TO take entire charge of small foundry and core room; man not afraid to work and who has a little capital to invest. Address Box 169, THE FOUNDRY, Cleveland, O.

WANTED:—FOUNDRY FOREMAN WHO CAN handle men and get results on light and medium castings. Give full details of experience. State salary expected. McLain graduate preferred. Address Box 137, THE FOUNDRY, Cleveland, O.

Help Wanted

WANTED:—A YOUNG GRAY IRON FOUNDRY foreman who is strictly up-to-date, accustomed to molding machines and can bring with him six or eight good floor and bench molders to start an open shop of about 25 floors to begin with, in a modern foundry building located in a city on New York Central Lines in New York State. Address Box 191, THE FOUNDRY, Cleveland, O.

WANTED:—FOUNDRY FOREMAN FOR GREY IRON Foundry, employing thirty moulders. Must be familiar with light and heavy work, all sorts of moulding machines and machine work, able to do own mixing, a pusher, cost cutter and producer. Very liberal salary paid. Address Box 192, THE FOUNDRY, Cleveland, O.

BASIC OPEN HEARTH STEEL PLANT IN MIDDLE West is in need of a Foundry Superintendent. The primary qualifications are a knowledge of the chemical and metallurgical problems in connection with the Open Hearth Furnaces and the executive ability to successfully handle a Foundry. Knowledge of Molding problems, etc., would also be valuable. Tonnage at present is about 70 Tons per week. Applicants should state in first letter age, experience and salary expected. Address Box 190, THE FOUNDRY, Cleveland, O.

Positions Wanted

POSITION WANTED BY A THOROUGHLY COMPETENT malleable superintendent. Up-to-date in methods and can produce results. Address Box 167, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS FOUNDRY FOREMAN have had 15 years experience on small and heavy work and can give the best of reference. Address Box 164, THE FOUNDRY, Cleveland, O.

UP TO DATE OPEN HEARTH STEEL FOUNDRY superintendent now employed desires to make a change. Have had 20 years experience in heavy and light steel castings. Can assume full charge of foundry. Address Box 170, THE FOUNDRY, Cleveland, O.

WANTED:—POSITION AS FOUNDRYMAN. ENgaged at present. Open for engagement January 1st, 1920. Wide experience in installing new plants. Malleable or gray iron. Reference first class. Address Box 171, THE FOUNDRY, Cleveland, O.

A YOUNG MAN WITH SIXTEEN YEARS FOUNDry and Machine Shop experience is open for a traveling position either on salary or commission and expenses. Address Box 172, THE FOUNDRY, Cleveland, O.

POSITION WANTED BY PRACTICAL FOUNDRYman. 18 years' experience as foundry foreman. Capable of taking full charge and estimating on all work of an up to date gray iron foundry. Address Box 961, THE FOUNDRY, Cleveland, O.

WANTED:—A POSITION BY A PATTERN MAKER foreman, familiar with medium and small work, wood and metal. C. A. Stemdown, G. D. Waterloo, Iowa.

GRAY IRON FOUNDRY FOREMAN DESIRES change; thoroughly experienced with all modern foundry practice, competent rigger, estimate costs from drawings. Best references. Address Box 146, THE FOUNDRY, Cleveland, O.

MECHANICAL ENGINEER DESIRES CHANGE OF position. Seven years apprentice and foreman pattern shop, iron, steel and brass. Technical education, experienced draftsman. At present has direct charge of about two hundred men on maintenance and construction of machinery. Age 35, married, no objection to some traveling. Address Box 162, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN WANTS A POSITION IN gray iron foundry. A No.-1 man on green and dry sands also molding machines now located in New York. Address Box 139, THE FOUNDRY, Cleveland, O.

YOUNG FOUNDRY FOREMAN WISHES TO MAKE a change. Have seven years experience on heavy and light gray iron and semi-steel casting. Have wide experience on test work. Can mix by analysis. Address Box 140, THE FOUNDRY, Cleveland, O.

COMPETENT FOUNDRYMAN. WITH EXPERIENCE of ten years as foreman. Now employed in a large up to date shop. Desires to change January 1, 1920. Would like to get in touch with good live progressive gray iron firm in need of a practical foundryman. Thoroughly familiar with all classes of work. Up to date on all modern foundry operation. McLain graduate. Address Box 141, THE FOUNDRY, Cleveland, O.

Positions Wanted

FOUNDRY OWNERS
ATTENTION!
FOR EFFICIENT FOREMEN AND SUPERINTENDENTS, AS WELL AS MOLDERS WHO WANT CHANCE TO MAKE GOOD AS FOREMAN — WHO KNOW MIXING IRONS BY ANALYSIS — CUPOLA PRACTICE AND WHO CAN MAKE REAL SEMI-STEEL—THE KIND McLAIN ADVERTISES WRITE

McLAIN SYSTEM, INC.
803 Goldsmith Bldg., Milwaukee, Wis.

POSITION OF FOUNDRY FOREMAN IN GRAY iron foundry by a molder and experienced Foreman. Would like small foundry jobbing and machine work. Am a practical man. Can mix iron, make semi-steel. Best of Cupola practice. Good executive. References furnished. Address Box 136, THE FOUNDRY, Cleveland O.

AS FOREMAN, ASSISTANT FOREMAN OR MOLDER in gray iron jobbing shop in California, preferably Los Angeles or vicinity; 20 years experience; thorough knowledge of Spanish; references. Address A. A. Rosanes, 338 23rd Ave., Milwaukee, Wis.

GRAY IRON FOUNDRY EXECUTIVE. 15 YEARS practical experience in foundry from A to Z. Also practical pattern maker. Can rig up patterns for best production at minimum cost. Up to the minute in modern and efficient foundry practice and a good handler of men. Address Box 179, THE FOUNDRY, Cleveland, O.

FOUNDRY SUPERINTENDENT—GRAY IRON, 35 years old, 11 years experience as an executive, understand molding machines, cupola practice, green and dry sand molding. Would consider a position in France or Belgium. Address Box 180, THE FOUNDRY, Cleveland, O.

ELECTRIC STEEL FOUNDRY FOREMAN SEEKS position; thoroughly experienced, also with converter, stove plate and heavy machinery, gray iron castings, technical education, at present employed as foreman with electric steel foundry on Pacific Coast; age 40, married. Address Box 182, THE FOUNDRY, Cleveland, O.

POSITION AS FOREMAN FOR ANNEALING DEpartment. Years of experience. Would prefer stove, plate and automobile castings. Address Box 189, THE FOUNDRY, Cleveland, O.

SUPERINTENDENT OR MANAGER
GRAY IRON FOUNDRY

Thoroughly experienced and competent foundryman qualified to supervise all departments of large foundry desires to make change for business reasons. Middle West Ohio preferred. Not interested in small proposition. Expect part of salary to be paid in stock of employing concern. Services available within reasonable length of time. A full investigation of present position with quantity and quality of production welcomed. Address Box 114, THE FOUNDRY, Cleveland, O.

BUSINESS EXECUTIVE EXPERIENCED IN VARIous manufacturing and industrial lines wants position as Manager, Assistant or Office Manager with growing and progressive concern. Competent to take full charge of business details, financial, accounting, manufacturing costs, credits, collections, correspondence, etc. Accustomed to accepting responsibility and getting results. Excellent references as to character, ability, loyalty, etc. Address Box 143, THE FOUNDRY, Cleveland, O.

PATTERNMAKER FOREMAN. EXPERIENCED ON foundry practice. Capable executive, energetic, resourceful. Best references. Address Box 125, THE FOUNDRY, Cleveland, O.

SUPERINTENDENT STEEL FOUNDRY, INCLUDING chipping shop and open hearth, large or small work, molding machines, duplication, executive, best references. Address Box 126, THE FOUNDRY, Cleveland, O.

POSITION AS FOUNDRY CHEMIST OR METALlurgist. Technical graduate. 4 years practical experience, 2 years laboratory experience in iron, steel, ferrous and non-ferous alloys, coal, coke and limestone, Analysis. 2 years experience test engineer in charge of laboratory, inspection of castings, forgings and rolling mill products, also control of cupolas and heat treating furnaces. Can mix cast iron and semi-steel by analysis. Age 24, single, available immediately. Minimum salary $1500. Address Box 133, THE FOUNDRY, Cleveland, O.

Positions Wanted

GRAY IRON
Foundry superintendent; experienced and capable wants to become associated with a plant which desires a foundry executive whose knowledge and service is worth more to them that what is merely represented by his salary; believe in molding machine production. Address Box 152, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN: UP-TO-DATE ON PUMP and engine work, thoroughly understands molding machines and metal pattern work, experienced in both Gray Iron and Brass. Address Box 370, THE FOUNDRY, Cleveland, O.

FOUNDRY SUPERINTENDENT DESIRES TO COMmunicate with first class concern who can appreciate service of competent foundryman. Years of experience in small and large foundries in United States and Canada. Experience embraces quantity production, molding, dry and green, molding machine practice and rigs. Broad training in cupola practice. Everything from designing room to market casting. Address Box 789, THE FOUNDRY, Cleveland, O.

FOUNDRY SUPERINTENDENT IS OPEN FOR POsition capable man heavy or light castings. References from reliable men. Address Box 109, THE FOUNDRY, Cleveland, O.

SUPERINTENDENT OF GRAY IRON FOUNDRY by practical foundryman up to date on jobbing and machinery work. Mix iron and make semi-steel. The best of cupola practice and good executive. References furnished. Address Box 135, THE FOUNDRY, Cleveland, O.

WANTED:—A POSITION AS FOREMAN OR superintendent by a practical foundryman with 22 years experience as foreman in both brass and gray iron foundries. Understands cupola practice, McLain's semi-steel and molding machines. References furnished. Address Box 186, THE FOUNDRY, Cleveland, O.

POSITION AS SUPERINTENDENT OR GENERAL foreman in foundry, making light or medium gray iron castings. Open shop preferred. Up-to-date on modern foundry practice and can furnish references. At present employed as superintendent. McLain graduate. Address Box 187, THE FOUNDRY, Cleveland, O.

HIGH GRADE MANAGER OR GENERAL SUPERintendent. Twenty-two years practical and technical experience in steel, iron, brass, malleable and aluminum foundries, pattern shop and machine shop. Expert in electric steel open hearth and converter steel, acid or basic. Good organizer and instructor of men. Highest of efficiency. At present I am general superintendent of machine shop, pattern shop, electric steel, brass and iron foundries. Age 38. Minimum salary $7,000.00 per year. Your proposition must be clearly stated and showing beyond question your need of a high grade man. Address Box 154, THE FOUNDRY, Cleveland, O.

WANTED:—BY A BRASS FOUNDRYMAN A POSItion as foreman. Can take position at once. 22 years experience. Good metal mixer. Address Box 156, THE FOUNDRY, Cleveland, O.

EXPERIENCED FOREMAN, REAL FOUNDRYMAN. Up to the minute in modern foundry and cupola practice. Expert on light and small gray iron castings, match-plates, squeezer and molding machines. Good rigger, tactful in handling men, get maximum production. References. Address Box 147, THE FOUNDRY, Cleveland, O.

SUPERINTENDENT OF STOVE AND FURNACE factory, would consider making a change. If you are in the field for a thoroughly experienced man in all branches of the work and one that understands modern shop practice, molding machines, etc. I will submit this chance to you. Address Box 148, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN. GRAY IRON FOUNDRY. Am up to date and a practical man with a technical education. Wide experience. Approximately twenty years. All classes of work including molding machines. Address Box 149, THE FOUNDRY, Cleveland, O.

FOUNDRY SUPERINTENDENT DESIRES NEW connections being a practical from molder to melter. Prefer a shop that is not paying. Can give the best of references as to ability. Prefer steel shop. Address Box 150, THE FOUNDRY, Cleveland, O.

WANTED:—POSITION IN CALIFORNIA BY GRAY iron foundry foreman. Address Box 151, THE FOUNDRY, Cleveland, O.

ELECTRIC CRANES

LADLES

2—½ ton Truck Ladles.
1—1 ton Truck Ladle.

BLOWERS

1—1½' Connersville Blower.
1—33' Connersville Blower.
1—No. 1 Garden City Positive Pressure.
1—No. 2 Garden City Positive Pressure.
1—No. ½ Roots.
1—No. 5 Wilbraham belt-driven Blower.
All sizes Fan Blowers.

AIR COMPRESSORS

1—6 x 6 Fairbanks, Morse with electric motor and electric control panel board.
1—8 x 8 Clayton Air Compressor.

AIR HOISTS

50—3000 lb. Capacity I-Beam Trolleys, ball bearing type.
5—Curtis 14" Cylinder 6' lift Air Hoists.

MOLDING MACHINES

6—Tabor Rock Overs.
2—Tabor Squeezers; will take 24 x 48 flask.

TUMBLERS

1—36 x 36 x 18 Square Tumbler—1" plate.
1—94" x 36" Whiting Exhaust Mill, ¾" shell.
1—36" x 60" Whiting Exhaust Mill, 1" shell.

MISCELLANEOUS

2—Ton Converter with No. 5-B Wilbraham Blower with base plate.
1—No. 5 Whiting Cupola.
1—No. 4 Whiting Cupola with extra set of lining.
1—Norton double floor stand grinder 1½" Arbor.
1—2000 lb. Fairbanks Scale.
1—Whiting Dump Car.
2—Whiting Steel Pig Iron Car.
1—25 ft. Whiting Hand Traveler.
1—2000 lb. Worm Driven Elevator.

Scully-Jones & Co.

Railway Exchange Building, CHICAGO, ILL

For Sale

FOR SALE

No. 3½ (51 inch shell) Whiting cupola in first class condition. Weir Stove Co., Taunton, Mass.

MR. FOUNDRYMEN, OUR WRITTEN GUARANTEE. Zipplers Patented Tuyereage System will pay for themselves in less than six months in savings of fuel alone, all other conditions on cupola greatly improved, Avalon, Pittsburgh, Pa.

POSITIVE FOUNDRY BLOWERS

No. 5½—6 and 6½ for motor drive.
Latest design. Perfect condition.
Low price to move quickly. Write for details.
Also other sizes, both new and used.
AIR ENGINEERING CO., Piqua, Ohio.

FOUNDRY FOR SALE

Fully equipped foundry capacity three to four hundred tons per month. R. R. siding rights. No better chance anywhere. Address E. B. Kreason, Hornell, N. Y.

CRANE LADLES, CRANES, COMPRESSORS, BLOWERS:—Crane Ladles all top out 3-5-8-10-20 tons capacity, immediate delivery. 15 belted air Compressors, 8 Air Receivers, 7 hand Traveling Cranes, 80 Blowers, Roots-Connersville, Sturtevant, Buffalo, Etc. Positive pressure, fan type, exhausters, disc ventilating fans. Cupolas, Sand Blasts, Gyratory Riddles, Swing Cut-off Saws. General foundry equipment. Write us your needs.
THE CLIFTON-PRATT CO., CINCINNATI, OHIO.

FOR SALE:—ON ACCOUNT OF OUR REPLACING our air compressor with a larger one we will sell at a reasonable price a 12 x 12 "Hill" straight lines, low pressure Air Compressor. Murphy Foundry Company, Beaver Falls, Pa.

THE FOLLOWING EQUIPMENT IN GOOD RUNning condition:
One—No. 4 Standard Cinder Mill, capacity six to eight hundred pounds of cinders per hour, complete with Settling Tank.
THE BUNTING BRASS & BRONZE COMPANY, Toledo, O.

FOR SALE:—THREE SECOND-HAND PNEUMATIC CHARGING TRUCKS, IN OPERATION NOW AND IN GOOD CONDITION. MICHIGAN MALLEABLE IRON CO., DETROIT, MICH.

FOR SALE:

The following foundry equipment:
One Buffalo 30" No. 6 Cupola and Forge Blower, almost as good as new.
One size 0 Sturtevant Forge Blower with 4" outlet.
One Adams-Farwell Molding Press M.P. 1.
One Obermayer Woodline Dustless Rumbler, never been used.
One lot of miscellaneous brass foundry small tools, such as ladle shanks, ladles, tongs, etc.
110 various sizes of small cast iron and steel flasks, some automatic adjustable snap and others plain.
Will send complete list on request to interested parties.
THE J. V. WALSH COMPANY,
Peoples Bank Bldg.,
Pittsburgh, Pa.

For Sale

FOR SALE:—2 PAXON-WARREN 36 X 48" SAND Blast Tumbling Barrels. In good condition. Manufactured by J. W. Paxon Company, Philadelphia, Pa. For information address Detroit Lubricator Co., Detroit, Michigan, Purchasing Dept.

FOR SALE
MOLDING MACHINE

One No. 3 Suspended Cradle Gravity Molding Machine, made by Buch Foundry Equipment Co. This machine will handle flask 70" x 60" inside dimension and is in A1 condition complete with motors for operating.
National Radiator Company,
Johnstown, Pa.

CORE OVENS FOR SALE:—

Two new and two slightly used No. 8 Monarch Core Ovens. Specifications: Outside dimensions, 9' 6" x 4' 6" x 2' 10". Have eight shelves 2' 3" x 4' x 6". Overhead draw pull allows opening of shelves singly or all at once. Oven closed when drawers are out by sheet steel shutters which form backs of shelves. Use either coal or coke. Apply
Manufacturers Foundry Company,
Waterbury, Conn.

FOR SALE OR LEASE:—WELL EQUIPPED foundry and pattern shop in good location in Arizona. Address Box 165, THE FOUNDRY, Cleveland, O.

FOR SALE:—MOLDING MACHINES. TURNER MAchine Co., make. Machines in excellent condition. The Edna Brass Mfg. Co., Cincinnati, Ohio.

FOR SALE:—1234 NO. 14 DIXON CRUCIBLES. 20 No. 14 Barton Crucibles. 1909 No. 30 Morgan Crucibles. We are in position to dispose of these crucibles at the old price (previous to 12½% advance). H. Mueller Mfg. Co., Ltd., Sarnia, Ont.

Wanted

WANTED:—CUPOLA, 42" TO 48" SHELL. ANY Standard make. Blakeslee Manufacturing Co., Du Quoin, Ill.

FOUNDRY WANTED

Want to lease foundry or building suitable for same, must be about 20,000 square feet area, with considerable yard room and railroad siding. Location near New York City preferred, but not absolutely necessary. Address Box 193, THE FOUNDRY, 220 Broadway, New York.

Wanted

WANTED:—A 28" OR 30" CUPOLA INSIDE A brick lining. Must be in good condition. Also 32" Schwartz furnace and a positive blower No. 1 or No. 2. Any good make in good condition. Address Box 178, THE FOUNDRY, Cleveland, O.

WE BUY FROM
250 TO 500 TONS

of iron furnace or stove castings every year. We would like to find a foundry within say 100 miles of Philadelphia, Pa., capable of making these castings for us. We want good deliveries and good castings; in other words, good service at all times. If you can meet these conditions we shall be glad to hear from you.

Address Box 181,
THE FOUNDRY, Cleveland, O.

SECOND-HAND FOUNDRY EQUIPMENT WANTED: Including cupolas, ladles, tumbling barrels, etc. Quote price and state condition. Address Box 287, THE FOUNDRY, Cleveland, O.

WANTED TO CORRESPOND WITH FOUNDRIES who are operating Electric Furnaces or contemplate installing same for the production of Gray Iron Castings. Can instruct melter to produce high grade Gray Iron and Semisteel from machine shop turnings or steel scrap, no pig iron required. Address W. L. Morrison, Met. Eng., 869 East 30th North, Portland, Oreg.

WANTED:—USED CUPOLA 45 TO 48" SHELL. Five to eight ton hand travelling crane, 25 to 30' span. Prefer equipment now in New England States. Address Box 166, THE FOUNDRY, Cleveland, O.

WANTED:—GRAY IRON FOUNDRY FOR LIGHT work. We have a client who wishes to either lease or buy gray iron foundry already equipped and ready for operation. Location preferred Southern Illinois, Indiana or Missouri. Building should be about 110 feet wide and 300 to 400 feet long. 5 or 10 ton electric traveling cranes desired in main bay. Address Clement A. Hardy Co., Room 654, Railway Exchange, Chicago, Ill.

WANTED:—WE CONTEMPLATE THE ERECTION of a modern grey iron foundry, complete with usual equipment for castings running up to 2 ton. Capacity of cupola 5-10 tons. Require large core oven capacity. Northern Indiana. We will consider purchase of well designed and well built used equipment, provided same not over 3 years old. When writing advise date of original purchase each article and name maker. SWENSON EVAPORATOR COMPANY, 945 Monadnock Bldg., Chicago, Ill.

McCORMICK'S FOUNDRY EQUIPMENT BARGAINS

CUPOLAS

Colliau—40", 44", 49" and 54".
Whiting—32", 36", 46", 51".
Other makes—60", 66", 96" and 100".
No. 1481—33" Colliau, 31' high, with No. 4 Buffalo Fan.
No. 1433—24" Cupola with Blower.

BLOWERS

Fan Type
BUFFALO—Nos. 3, 5, 6, 8, 10, 11 and 12.
STURTEVANT—Nos. 4, 6, 7, 8 and 10.
AMERICAN—Nos. 5 and 7.
Positive Pressure Type
ROOTS—Nos. ¼, ½, 1, 2, 3, 4, 5 and 6.
GREEN—No. 3; also special outfit, motor driven, delivering 250 cu. ft. of air per minute at high pressure.
CONNERSVILLE—3.3 cu. ft., 6, 13, 17, 24, 57 and 60.
PIQUA—No. 5½ and 101 cu. ft.
BAKER—No. 5, for motor drive.
STURTEVANT—5 cu. ft.

LADLES

1402—5000-lb. worm geared ladle, bottom pour.
1402—2—5000-lb. spur geared ladles, bottom pour.
1329—35-ton bottom pour ladle.
1523—40-ton bottom pour ladle.
1523—60-ton bottom pour ladle.
1421—10-ton geared reservoir ladle.
1363—3000-lb. 4-wheel buggy ladle, not geared.
1403—2000-lb. geared buggy ladle, 16" gauge.
1403—8000-lb. geared buggy ladle, 16" gauge.
1463—250-lb. sky ladle.
1502—2—1800-lb. Trolley Ladles.
1573—10—25-ton bottom pour ladles, not geared.
1581—2000-lb. worm geared teapot spout crane ladle.

CRANES

JIB—
2 to 5 tons capacity, hand power and pneumatic.
HAND TRAVELERS—
1598—4-ton, 34' span.
1447—5-ton Northern, 30' span.
1598—5-ton, 17' span.
1596—5-ton pendant type, 28' 2" span, 15' lift.
1255—6-ton Whiting, 11' 1½" span.
1598—10-ton, 31' span.
1389—15-ton, 70' span, with runway.
1496—20-ton Whiting, 36' span, 20' lift, with runway.
1174—35-ton, 33' 2" span, no hoist or trolley.
ELECTRIC TRAVELERS—
1330—3-ton, 37' span, 2 motors, 110 volts, D.C., floor control.
1535—5-ton, 36' span, 3 motors, 220 volts, D.C.
1447—5-ton, 30' span, 25' lift, 500 volts, 3 phase, 60 cycles, A.C.
1566—10-ton Shepard, 67' span, 3 motors, 220 volts D.C., 35' lift.
1511—15-ton Cleveland, 58' span, 220 volts, 3 phase, 60 cycles, 3 motors.
1536—15-ton, 62' span, 3 motors, 220 volts, D.C.
1603—15-ton, 40' span, cage control, A.C.
1352—20-ton, 41' span, 3 motors, 220 volts D.C.
1508—25-ton, 50' span, cage control, D.C.
1342—30-ton, 75' span, 4 motors, 220 volts D.C., with 10-ton auxiliary hoist and 170' runway.
1602—30-ton, 65' span, 36' lift, 220 volts D.C., with 5-ton auxiliary hoist.

HOISTS

1515—2000-lb. Air Hoist, 15' lift, complete with winding rope and all attachments for elevator.
1509—6-ton Harrington Improved Screw Hoist.
1509—8-ton Harrington Improved Screw Hoist.
1422—1500-lb. Air Hoist, 5" x 12', 80-lb. pressure.
1569—2-ton, 2 motors, Monorail, 17' lift, 220 volts, 3 phase, 60 cycles, A.C., floor controlled.

MOLDING MACHINES

Hand, Air and Electric—Squeezer, jarring, roll-over, stripping plate—
Adams, Tabor, Berkshire, United States, Osborn, Arcade, Cleveland, Reynolds, International, Mumford, Hermann, Pridmore, etc.

BRASS FURNACES

Crucible—all sizes from No. 40 to No. 275, for coal, coke, gas or oil fuel, tilting or stationary types.
1587—32" Schwartz Furnace with hood and stack.
1432—42" Schwartz, style "B," oil fuel.
1542—60" Schwartz, style "B," oil fuel.
1477—90" Schwartz, style "B," oil fuel.
1058—2000-lb. capacity Wiles Electric Furnace.
1521—Hausfeld Furnace, oil or gas, with new lining and No. 50 Connersville Blower.
1487—No. 92 Simplex non-crucible, oil or gas, 500-lb. capacity.
1487—No. 1 Double Chamber, non-crucible, oil or gas, 600-lb. capacity.
1571—50" Schwartz Furnace.
1596—60" Schwartz Furnace, class "B," with blower and oil pump.

FLASKS

1541—90—18 x 18 C. I. Flasks, 16" cope, 2¼" drag.
1547—35—10 x 17 C. I. Flasks, 2" cope, 2" drag.
1539—15—12 x 18 Diamond Steel Jackets, 6" deep, style "E."
1424—50—12 x 17 C. I. Flasks, 2½" cope, 2½" drag.
1548—100—12 x 16 C. I. Flasks, 3" cope, 3" drag, tapered.
1604—50—42" dia. round Sterling Steel Flasks, 7" cope, 14" drag.

GRINDING PANS

1130—3' Wadsworth Universal Sand Mixing and Compounding Mill with Riddle.
1427—7' Raymond Wet Pan.
1457—9' Dry Pan.
1552—4' Simpson Intensive Foundry Mixer.

TUMBLING BARRELS

1463—24 x 54 Channel Stave Tumbler, without stand or pulleys.
1452—36 x 50 C. I. Stave Tumbler, with tight and loose pulleys.
1050—25 x 28 Water Tumbling Barrel, door 11" x 8½".
1540—26 x 36 Tumbler, door 12 x 9, with tight and loose pulleys, on wood stand.
1553—30 x 42 C. I. Stave Tumbler.
1579—30 x 48 C. I. Stave Tumbler with countershaft.
1554—26 x 48 C. I. Stave Tumbler.
1564—Four 20 x 36 C. I. Water Tumblers, in one battery.

SAWS

1094—8—Williamson Metal Band Saws, capacity up to 10" round and 12" "I" beams, cuts at any angle, adjustable table.
1424—32" Power Band Saw with 10 blades for cutting metal.

CORE OVENS

1424—Portable Core Oven, coal or coke fuel, similar to Millet.
1567—Sliding Drawer Core Oven.
1460—2—No. 2 Crawford Sectional Ovens, 10' 8" wide, 12' deep, 6' 6" high, natural gas fuel, double set of swing doors.
1558—2—Portable Core Ovens, coal or coke fuel, two shelves 6" high and one shelf 11" high, all 24" wide, 33" deep, similar to Millet.
1590—2—Millet Portable Core Ovens, coal or coke fuel.

CORE OVEN CARS

855—30—2-ton all steel cars, 42" x 72", 24" gauge track, roller bearing wheels.
1466—6—3 deck cars, 24" gauge, roller bearing wheels, channel iron frames.

SAND MIXERS

1396—No. 3 Chicago Air Sifter.
1146—No. 3 Standard Sand Mixer with revolver screen and elevator, with motors for 220 volts, 3 phase, 60 cycles A.C.
1139—Battle Creek Air Sifter, screen 18 x 30.
1381—No. 0 Deane Pneumatic Sand Sifter.
1530—2—Combs type "V" Gyratory Foundry Riddles, 440 volts, 25 cycles, single phase A.C.

ELEVATORS

1061—3000-lb. Morse, belt drive, platform 4' x 5', 45' lift.
1538—3-ton Curtis Pneumatic, 20' lift, cage 7' 6" x 6' 10".
1515—2000-lb. Air Hoist, 15' lift, complete with winding rope and all attachments for elevator.

SAND BLASTS

800—No. 8 Pangborn, type "C."
1411—No. 8 Pangborn, type "AG," with oil and sand separators.
1453—No. 4 Pangborn outfit, complete.
1456—30 x 36 Ducklieb.
1545—No. 8 Sly Rotary, with dust collector and exhaust fan.
1532—American Wadsworth 6' Revolving Table Sand Blast with steel room.
1589—No. 6 Pangborn, with hose.

SUNDRIES

1220—36" Cutler-Hammer Lifting Magnet, with drum, cable and motor-generator set.
1456—Diamond Emery Grinder, two wheels 12" x 1".
888—12" Sterling Floor Water Tool Grinder and c/s. wheel 12" x 2".
1458—80,000-lb. Riehle Tensile Testing Machine.
1424—Brass Foundry Drying Stove.
1341—No. 4 Standard Cinder Crusher.
1113—2000-lb. Portable Scales, platform 21" x 30".
1486—10—Rolling Doors, 9' 8" x 9' 6", complete with guides and operating chains.
1506—10—Pig Iron Barrows.
1505—400-lb. Coke Barrow.
1574—Power Sprue Cutter, capacity 2¼" round or 2" square, belt drive.
1575—2-ton Portable Scale, platform 30" x 38", very substantial.
1575—Duplex Electric Sand Shaker, 3 phase, 60 cycles, A.C.
1557—36" E. C. & M. No. 3 type SA Lifting Magnet, 125 volts D.C., with controller.
1552—2-ton Converter.
1586—5—Ingersoll-Rand Air Floor Rammers.
1594—12 x 12 Hill Air Compressor, horizontal type, capacity 150 cu. ft. of air per minute at 15-lb. pressure.
1596—Buchanan 12 x 30 Portable Magnetic Separator.
1565—No. 1 Rich Sand Blast Barrel, 20 x 34, with dust arrester and exhaust fan.
1567—26 x 47 New Haven Sand Blast Barrel.
1567—No. 3 Wadsworth Power Core Machine.

J. S. McCORMICK COMPANY, Pittsburgh, Pa.

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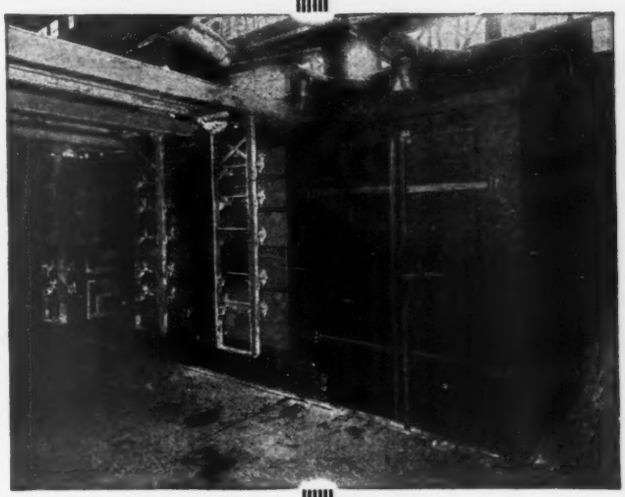

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